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WEIGHT COMPARISON CHART
WIG-O-FLEX COUPLING VS. AN FLANGE AND FLANGE TUBE CONNECTION

Know-How is the Pay-Off



Hayes has been awarded a contract to IRAN to modify KC-97 boom-type tankers, due to Iran's broad experience in aircraft rebuilding. This contract involves IRAN rebuilding KC-474 for single power reflecting.

Hayes has a well-developed, efficient Test Station for rebuilding systems. In addition to the present KC-97 contract, Hayes has performed numerous major projects on rebuilding tankers, such as the KV8-20T conversion of basic B-29 bombers, and the KB-50 conversion of B-50 basic bombers into three power probe-and-droop tankers. Over 40% of the KB-50 conversion is completely new in design, requiring more than 6,000 new engineering drawings. Hayes has the know-how in aircraft engineering, aerodynamics, electronics, fabrication and assembly for overhaul/modification of all types of aircraft, under strict cost control. Hayes is the only contractor working on both boom-type and probe-and-droop tankers.



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AVIATION CALENDAR

- Aug. 15-17—Meeting of the Aeronautical Society, National Business and Aviation Transportation Meeting, Coast Hotel, San Diego, Calif.
- Aug. 22—National Teleworking Conference, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers, Institute of Aeronautical Sciences and Instrument Society of America, Sheraton Hotel, Los Angeles.
- Aug. 22-24—Western Quality Control Conference, sponsored by Aeronautical Society of America, American Society for Quality Control, 1111 Santa Fe, Los Angeles.
- Aug. 22-24—Smithsonian Institution's 1956 International Systems Conference, Sedona, New York.
- Aug. 27-29—Association for Computing Machinery annual meeting, University of California, Riverside Campus, Los Angeles.
- Sept. 1-3-1956 National Aero Show, 9140 Rogers Field, Oklahoma City.
- Sept. 1-5—Canadian National Air Show, Toronto, Canada.
- Sept. 1-5—Security of Search Aircraft Conference, 17th Annual Air Show, Royal Aircraft Establishment, Farnborough, Hampshire, England.
- Sept. 4-10—International Northwest Aviation Council, 26th annual conference, Boca Raton.
- Sept. 10-14—American Society of Mechanical Engineers Instruments & Reproduction Meeting, Denver, Colo.
- Sept. 16-22—American Society for Testing Materials Second Pacific National Meeting and Apparatus Exhibit, Grand Staircase, Las Vegas.
- Sept. 17—International Air Transport Association, 12th annual general meeting, Pittsburgh, Scotland.
- Sept. 17-21—Soviet Annual International Automatic Conference & Exhibit sponsored by the International Society of Air in Columbus, New York, N. Y.
- Sept. 17-22—International Congress of Aeronautics, sponsored by the International Aeronautical Federation, Rome, Italy.
- Sept. 22-26—American Society of Mechanical Engineers Division of Aerospace Engineering, 19th Annual Meeting, Fort Lauderdale, Fla.
- Sept. 24-26-1956, Trade Fair of the Aeronautical Industry, New York, Chicago.

AVIATION NEWS • AUGUST 12, 1956

... (Small text block containing various aviation news items, including mentions of aircraft models like the F-101, F-102, and various industry reports.)

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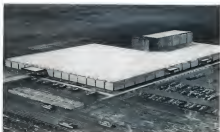
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F. G. Anderson and Donald P. Harsh Architects Dallas

Idea center for new designs in complete aircraft and weapons systems, test lab for tomorrow's planes and missiles, ultra-modern workshop for a growing line of expansion.

Increasing assignments for development of such Temco projects as the Navy's ET-1 jet primary trainer, plus important subcontract

in metals and electronics work, have doubled Temco's Engineering Department within the past two years.

Temco's new million-dollar Engineering Center is designed to permit further expansion at any time. Future programs, already under negotiation, promise yet another doubling in the near-to-come future.

What is This?



This is a blueprint for tomorrow's air transportation. It's Temco engineering at work on design of components for America's first turbo-prop airliner — the Lockheed Electra.

Temco's proven engineering ability was a deciding factor in winning this important contract — engineering, tooling and manufacturing systems, wing flaps and tips, landing gear assemblies. For the commercial Electra project, Temco is providing the same drawing-board-to-delivery service that is currently at work on fourteen of the nation's top military aircraft.



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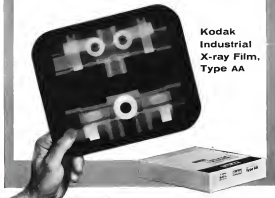
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With more than 1300 hours of helicopter flight time, mostly in Bell H-19, Lt. Ritchie is now an instructor at the Army Aviation Center, Fort Rucker, Ala. Here, he is teaching seasoned pilots and aviation cadets helicopter tactics that apply directly to the Medical Service Branch.



Lt. Ralph D. Ritchie
in need to the medical



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COVER Stuart Carville has selected experimental prop airplanes for Air Force. This is first of 22 of the technologies jet aircraft which will begin production service around end of next year. As part of Carville's experimental program, Air Force used two from Algeria to Paris using only one jet engine. Flight at crossing altitude of 26,000 ft. took 7 to 8 min. British Kolls-Rover jet Canada by jet engine are custom built for future Super-Carville. For more on Carville, see page 77.

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Cover—Tommy Boy

66,677 copies of the issue printed
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Monthly AET and ABC

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B. F. Goodrich panel materials combined with Pressure Sealing Zippers (made only by B. F. Goodrich) can be used for engine cowlings, inspection ports and access gip seats. There are many other aircraft uses, these listed to be sure for you. Write: B. F. Goodrich Division Products, a Division of The B. F. Goodrich Company, Akron, Ohio.

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EDITORIAL

Congress Leaves Sorry Safety Record

Members of the 84th Congress departing from the Capitol to further their individual political goals in the legislated left behind a sorry, shameful record on the vital issue of aviation safety. Congress came close to establishing a new Capitol Hill record for the amount of time required by aviation industry executives and government aviation officials to testify before a wide variety of Senate and House committees concerned with the perplexing problems facing aviation and its federal regulators.

On the military issue, the second session of the 84th Congress vigorously fought for stronger approval and a better price in research and development for aerial weapon systems to insure continued qualitative superiority.

In facing the issues of civil aviation, particularly that of improved safety, the record of Congress was unambiguously negative. Even after the tragic collision of a United Airlines DC-7 and a Twin West Airlines Super Constellation over the Grand Canyon that cost 128 lives, Congress displayed a calloused attitude toward approving any effective steps for better air safety.

\$23 Million Cut

In one of its porting gestures before leaving Washington, the House Senate conference cut \$23 million from the Civil Aeronautics Administration request for \$68 million for new electronic federal airways equipment so desperately needed to alleviate the air traffic control bottleneck.

Congress made this major slash shortly after members of the House Interstate and Foreign Commerce Committee's Aviation Subcommittee returned from a six-week tour in Las Vegas at the taxpayer expense. Alleged purpose of the fact-finding jaunt to the gambling capital of Las Vegas was to investigate the Grand Canyon collision. Actually, only three of the nine Congressmen even bothered to go to the Grand Canyon accident scene with CAB Chairman James Doolittle.

Las Vegas Weekend

The others barely stayed from the air conditioned comfort of the gambling casinos. They took time out only for a stop-look forward having organized primarily for the benefit of television cameras. After this Las Vegas (stint) held, with the assembly of the Grand Canyon crash still fresh, the House and Senate voted unanimously and without debate to make the House-impoverished airports safe.

As an added bit of irony, numerous members of the House introduced new legislation to establish a Congressional air safety commission just after they voted to

close the Fiscal 1957 electronic airways budget. All the Congressional investigations on air safety of the past decade have resulted in headlines for the investigation and nothing for improved air safety.

Another action by the 84th Congress that set back air safety was a \$300,000 cut in the Air Navigation and Development Board's research program. This cut broke the spirit of the ANDB and was instrumental in its speedy disintegration this summer.

Burke Shelved

The second session of the 84th Congress also added another cut chapter in the already dismal history of the Burke, Va., airport project designed to provide the nation's capital with a modern airport capable of handling jet-age traffic and relieving the dangerous congestion at the National Building Associates air traffic complex. A tiny group of Maryland legislators who want to force Washington air traffic to use the Baltimore-Friendship terminal and Virginia congressmen, who just don't want an airport again, blocked the Burke project and referred it back to Congress for further study.

There is absolutely no hope that the airlines serving Washington will or consent to force their customers to use Baltimore's airport instead of a terminal in the Washington area. Nor is there any hope of operating major jet transports from the current Washington airports with existing traffic density and runway facilities. In postponing action on the Burke airport project, Congress again kicked the traveling public in the teeth and in effect condemned them to increasingly dangerous operations in the Washington area and denied them the opportunity to use jet transport when it is ready.

It has taken a long time for the Eisenhower administration to wake up to the frightening facts of the current air safety situation. After three years of stalling an emergency program on all projects pertaining to air safety, the Eisenhower administration suddenly was stirred into action last fall by the House Committee report on the increasing hazards of the air traffic control problem. Since then it has made a belated effort to pump money—but still far from adequate—funds into this sector, according to Edward P. Clark, a presidential aviation adviser to organize long-range planning for better air safety and provided vigorous leadership for the Civil Aeronautics Administration. But Congress has still to catch up with the local facts of the air safety outlook. Only a concerted, sustained effort by all concerned will shake the new Congress out of its traditional apathy toward air safety.

—Robert Hertz



Left to right, from top to bottom: McDonnell F-401, North American F-108, Convair F-106, Boeing B-52, North American F-4, F-8B, and F-4E, Lockheed C-130, Douglas DC-7, Sikorski S-61 and S-63

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• 405 Lexington Avenue, New York 17, N. Y.

WHO'S WHERE

In the Front Office

Paul H. Bala, board chairman and chief executive officer, and **J. E. Rhein**, president and general manager, **Boeing Aircraft Corp.**, Chicago, Ill., Calif.

Russ Stewart, board chairman, a director of **Continental Air Lines**

W. Bruce C. Foster, executive vice president of **U.S. Maritime Chemical Corp.**, elected board chairman **Boeing Materials**, Inc., Downey, Ill.

Frank W. Glass, executive vice president and general manager, **Allyl Fastener Corp.**, a division of **Morton Corp.**, Easton, Pa.

Clifford H. Fox, a director and vice president-convalescent, and **Gordon K. Johnson**, vice president-production, **Grumman Aircraft Engineering Corp.**, Bethpage, N. Y.

Marvin E. Rubin, vice president-general manager, **Raytheon Grouping Co.**, Santa Monica, Calif.

Dr. Houshaig H. Kierweg, American Technical Director, **Aviation Research Corp.**, 1500 California Laboratory, White Oak, Silver Spring, Md.

E. H. Rice, general manager, and **R. H. Reed**, assistant general manager, **Los Angeles Division**, **North American Aviation, Inc.**, Los Angeles, Calif.

Alvin J. K. Smith, vice president-administration, and **N. S. Houston**, executive vice president and operations planning director

Paul F. Slay, president-general manager, **Aero Vertec Limited**, Toronto, Canada. Also, **Joseph T. Wainwright**, vice president-general manager, **Boeing Aircraft Corp.**, Downey, Calif.

F. H. W. Ross, corporate and technical, **N. E. Shedd**, secretary

Honors and Elections

Donald W. Douglas, board chairman and president, **Douglas Aircraft Company**, Inc., will receive the annual award National Defense Transportation Association's Award as "the person who has made the most outstanding contribution to military transportation in the preceding year."

Blair F. Yankov, president **Sprey Road Corp.**, will receive **The Aviation Section of Mechanical Engineers' Medal** for "his inspired service in engineering and design."

Changes

William E. Mann, secret service manager, **Westinghouse**, Victoria, Ind., Detroit, Mich.

Carl Nelson, manufacturing operations manager, and **Melvin Scherberg**, planning operations, **Cherry Hydroline, Inc.**, Jamaica, N. Y.

Carl Edward G. Rosen, general operations representative, **Boeing Aircraft Corp.**, Los Angeles, Calif.

R. Lynn Ferguson, military contracts manager, **Lockheed Aircraft, Inc.**, Santa Ana, Calif.

W. C. Heald, research manager, **Solar Aircraft Company**, San Diego, Calif.

INDUSTRY OBSERVER

► Six states have now passed legislation authorizing the Air Transport Association, The Air Carrier, Candler, the Federal Communications Commission, Liberty, Madison, Radio City of America and the Radio-Worldwide Corp. Radio-Worldwide Corp. had asked ATA to make sure the estimated \$750,000 development cost. All six states reportedly are now prepared to authorize their own development programs, saving ATA only for maintenance to service the program.

► General Sound Control, Inc., of Los Angeles, has designed an exhaust exhaust silencer for jet engines which functions by absorbing the exhaust stream. Other types generally have depended upon increasing the turbulence of the exhaust. New design is expected to improve aerodynamic performance enough to offset the added weight of the silencer.

► Flight test program of the X-10, test vehicle for the Navaho atomized missile, is nearing completion at Patrick AFB, Fla. Flight testing of the vehicle, manufactured by North American Aviation, Inc. and powered by two Westinghouse J46 turboprops, was carried out to study all-around aerodynamic design, electronic systems and general flight characteristics. The program was begun sometime two years ago (AVF Feb 15, 1954, p. 11). Production models of the Navaho will be produced by two Wright engines.

► Plans to build the Sikorski S-55 helicopter under license, Authorization of the program probably will be made by the French Ministry of Defense. Sikorski, however, is expected to give up its option to manufacture the Sikorski H-23 (AVF March 26, p. 32), with action continuing to be placed on the U.S.

► Sixteen sets of landing gear legs have been built for the North American C-124L aircraft. Legs are of conventional cantilever structure and apparently are retractable into the fuselage body. A tail wheel may also be used. Only one full landing of a C-124L has been reported. The landing gear was designed during a land landing. There was no damage to the surface.

► Details plans to spend between \$10 million and \$12 million during the current fiscal year for increased production of the Spry Sparrow 80-2000 guided missile. The Sparrow will replace the Caspian/Starburst Vohel Giver (AVF Nov. 23, p. 7), which was abandoned after initial production clearly had begun and \$24 million had been spent on its development.

► New contracts reported by the USAF for work on the strategic missile program include Bell Telephone Laboratories and Ammunition Research Corp. (Aviation), both of whom are developing guidance systems, and the American Machine and Foundry Co., which will develop auxiliary propulsion units.

► A V-10's new supercruise, delta wing C-105 fighter has a gross weight of 26,000 lb. By comparison, the **44-engine Convair 440** gross 47,000 lb.

► **Foxtrot CM 170-M**, naval version of the French Magister trainer equipped for carrier operations, including catapult launchings, has made its first flight. The French navy has ordered two prototypes.

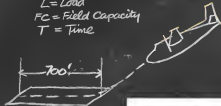
► Sikorski's twin-engine S-55 helicopter is experiencing unusual vibration in the drive shafts between the outboard-mounted propellers and the main rotor gear box. One of the shafts recently failed in flight, but the helicopter was landed safely.

► Configuration configuration of the Lycoming T53 permits a very slight engine with rigid, simple hot-end inspection. Axial combustion with double 180 degree turn is folded back over the turbine so that mounting the rear end exposes both the turbine and combustor. The same configuration will be used on the T55 with twice the SPS rpm of the T53.

► Conventional helicopter engines are subjected to twin rotor design because the rotor diameter of the two-rotor machine is small as compared with the single rotor, and order of gear arrangement is much more geometric.

$$\frac{L \times FC}{T} = C-123$$

L = Load
FC = Field Capacity
T = Time



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North Situation: 10 105mm howitzers, with ammunition and gas canisters, plus 10 bulldozers and operators must be delivered in a camp-surrounded field. **Field conditions:** Ungrazed field, steady winds, 1000 ft. at its widest dimension. Average 15 mph westerly wind. Troops must be ground loaded. **Solution:** Load 10 Fairchild C-123

assault troops at supply center 450 miles away, take 3 hours to fly to destination. Land your supplies in seconds again—allow 700 ft. ground roll for each. **Threat:** Fairchild C-123 rugged performance and reliability is proved by its standard visual and precision optical systems.

WASHINGTON ROUNDUP

Nuclear Arsenal Grows

"New principles" being applied at Atomic Energy Commission laboratories at Los Alamos, N. M., and Livermore, Calif., are "very interesting," the faculty of one of our streets.

Without going so far as to what the new principles might be, the commission's 23th semi-annual report to Congress said:

• "In order to facilitate early production of the weapons conceived in the Livermore Laboratory, it has become necessary to increase weapons production facilities and to provide ordnance engineering facilities at Livermore, in addition to those currently provided at Albuquerque, N. M., by the Sandia Corp."

Sandia will continue for the expanded ordnance engineering facilities, and "the expansion is expected to result in a significant increase in employment," both in the Livermore Laboratory and at the Livermore Branch of Sandia.

• Construction has begun on an \$35.4 million addition to the weapon production facility at Rocky Flats northwest of Denver, Colo. "New construction includes two new process buildings and additions to three existing buildings."

• "Contingency, necessary expansion of other weapon production facilities is planned."

Twining and Single Service

USAF Chief of Staff Nathan F. Twining says he "leans" towards a single service concept but not without reservations. The General goes far over on the controversial subject in testimony before the Senate Aerospace Inquiring Subcommittee.

He said, in part:

"I think it would enable us to consolidate and be settled promptly when the cross-up between the services. Sometimes that is a good thing, sometimes it is not."

"I think, it could be less expensive than the present organization. However, I still feel that the three services working each other is a pretty healthy thing, because as one can get into the habit. With a single service you might get a sort of chronic dry-rotting up that could make a real bad mistake for the United States."

"The single service could be both up and get on strong, through the individual personalities, that they might have an idea about what was best for the United States and do something about it."

(His other views on the single service concept, see page 25.)

AFA Riles Wilson

Air Force Association awards to Democratic Sen. Stuart Symington and Texas Governor, two key votes of Defense Department support policy, mild scientific temper in the Pentagon. Secretary Charles E. Wilson made an effort to keep USAF Secretary Donald A. Quarles from giving his resignation to quit at the commission's views (except to New Orleans. Chief of Symington is "Austrian's Man of the Year" for his "unparalleled ingenuity" was reference to Wilson, but the General's criticism caused a real blowoff. The retired assistant secretary of the Air Force, who quit with a

scathing denunciation of the administration's attitude toward research and development, was invited by AFA for his "courageous leadership." Quarles stood firm in face of pressure, argued that he could not return to 8th command.

In his address, he occupied AFA to a college alumni organization that sometimes wants to fix the school president or the football coach.

Tighter Procurement Policy?

Defense Department's tougher and greater revision of the Armed Services Procurement Regulation (an act, although probably not be completed until 15 months or two) "The actual initiative will send closely for tightened ASPR on the matter of salaries and bonuses as result of congressional hearing on industry profits. Chairman F. Edward Hebert (D-La.) of the House Armed Services Investigating Subcommittee, said he was "impressed" by the course of some annual officials ASPR, however, applies to all industries with defense contracts.

Security and Absurdity

Defenseur in Gen. Nathan F. Twining, USAF Chief of Staff, first an unannounced had set a speed record produced six primary shareholders at the Air Force Area's New Orleans convention. The fact that the record was set on July 25 at Edwards AFB by Lt. Col. Frank K. Everett in the Bell X-2 at 1,900 mph had been published in the morning newspapers despite Defense Department security efforts to keep it a secret. Two days later, Col. Everett received AFA's "Pilot Award for 1956" before a packed double ballroom. Still he "I find making this unofficial flight I apparently made in the X-2 would be easier than standing here tonight." Everett, pointed in an array of systems covering the exercises, kept his lips sealed, refused to discuss his X-2 accomplishments.

His top boss, USAF Secretary Donald A. Quarles, said only: "I agree with General Twining."

SAC Disperses

Strategic Air Command is stepping up its dispersal of bomb units. Beginning late next year, SAC will operate from 10 AFBs: Miami, Barks AFB, Calif., Chisago, Wisconsin AFB, Okla., Griffiss AFB, N. Y., Mather AFB, Calif., Muroc AFB and Grand Forks AFB, N. D., Columbus AFB, Miss., and three fields in Texas—Beckton, Seymour and Altus-Flt.

About 1,500 to 2,000 personnel will be moved in with each unit.

Another Soviet Victory

National Science Foundation reports that Russia had more than 100,000 science graduates in 1956. The U. S. Science field graduates at the Soviet Union totalled 120,000, of which 70,000 graduates course of engineering degree.

In the U. S., there were 51,000 science graduates, 22,559 of them in engineering.

—Washington staff.

Curtiss-Wright Aids Ailing Carmaker

Air Force blocked B-47 retrofit with J65 engine, but accedes on other Studebaker-Packard contracts.

New York—Follow-on orders substantially less than an existing \$19 million subcontract with the Studebaker-Packard Corp. for B-47 engine components and auxiliary structures to overhaul 147 engines are in progress now. That Curtiss-Wright Corp. has signed the papers agreeing to bid on the job, or order.

The latter is a day, however.

Retaining. Of 40 engines of 13 bombers built J65 engines. A17 June 18, p. 21) which would have been made at the Studebaker-Packard plant, is not USAF. Both approved the plan when it was passed along from the Department of Defense.

Deliver. Contracts with the Studebaker-Packard and Curtiss-Wright and Johnson were to complete.

Studebaker-Packard's B-47 subcontract is with the Air Force. For the first half of the B-47 program, the new engine was to be about 5300 net horsepower. Studebaker-Packard has been doing about 2000 horsepower on one part of Ford's work. The rate is expected to continue if the Air Force is satisfied that Curtiss-Wright's bids are competitive.

USAF probably could have had the work done elsewhere, but the aircraft has moved.

The competition envisaged these limits:

USAF now concerned primarily with keeping the Studebaker-Packard unit going and available to the defense effort. The "preference" was not considered out of fear for the objective.

Preference in the administration might be applied to the objective, a bid submitted passed and possibly election campaign opening at the same time. Studebaker-Packard was shifting the line down, being out 12,000 engines in South Korea, Italy and Germany.

Defense Secretary Charles Wilson and Treasury Secretary George Thayer play also mentioned in Washington as those who were active in the Packard-Studebaker acquisition.

Cost: \$1 Billion

When things began to look serious for Studebaker-Packard, the company lost \$10 million in 1954, \$25 million in 1955. The 1957 losses were greatly amplified on various large operations or help by Studebaker-Packard. None official is.

Then Curtiss-Wright, in the person of Roy J. Hotley, president and general director of Curtiss-Wright, made the B-47 retrofit proposal as a plan to bail out

Studebaker-Packard. Curtiss-Wright had not lost among the competitors originally approached by the government.

Aer B-47 retrofit program would cost on the order of \$1 billion. The major of the B-47 would be replaced by introduction of the J65, but no gas would be possible in speed or altitude.

USAF is now of an anti-aircraft program, including losses on this scale would be a big setback for a brand new company station. Though fully respecting the proposal which emanated from the top level of the Department of Defense, with an input from the cabinet, the Air Force did not close the door to doing something to share out Studebaker-Packard.

Senator Wilson was asked at the press conference last week whether the government had planned to put 400 million J67 components out, has been done at Union, but the plant is not an efficient one for this work, and it will be transferred to South Bend.

Hotley, at Washington, exhibited considerable knowledge and specific discussion of defense work.

"The day has come to us end," he said, "which we can use a company to define business."

Non-Diversification

"Through Hotley and Curtiss-Wright we are involved in a big way," he said, "and I'm proud of the company." He said that 90% of the \$100 million net earnings were from non-stable business. Curtiss-Wright has never diversified. It makes a total net of about \$20 million in 1953, \$10 million in 1954, and \$10 million in 1955. It also makes products using plastics, steel, plastic spacers, and plastic spacers.

Curtiss-Wright's plastic engine components touch on another aspect of the organization that is still going. It is the participation of the General Motors jet engine plant, Detroit, Mich.

Engineer Henry, now operating, high performance cars, and diesel trucks and buses. It is Mercedes-Benz racing cars, which is a fuel injection engine, also with European cars and Mercedes' airplane from some jet role.

Hotley says his idea was suggested as getting back into the second engine field, especially into turbine engines (AW May 12, p. 128). The Curtiss-Wright acquisition still being separate from the other B-47 retrofit, it is possible that Curtiss-Wright has rights to restore Curtiss-Wright project they needed it.

"How much will Curtiss-Wright do for Studebaker-Packard? Hotley said at a press conference last week. The Curtiss-Wright said that 90% of the \$100 million net earnings were from non-stable business. Curtiss-Wright has never diversified. It makes a total net of about \$20 million in 1953, \$10 million in 1954, and \$10 million in 1955. It also makes products using plastics, steel, plastic spacers, and plastic spacers.

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None of the \$200 million in business was reported by Hotley. Instead, the B-47 retrofit will be done at Union, and the B-47 work, Studebaker-Packard had not lost among the competitors originally approached by the government.

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A new flying saucer is expected early only during installation on Navy WV-2 Super Constellation. It is a new type engine containing a turbine engine. Missing now (less 30 lb) was the diesel engine and supporting staff on stand at profile WV-2 installation. No possible installation is scheduled for tests at Lockheed Burbank, then volume is to be defined and tested to Lockheed Air Force Base for extensive test program.

Navy's Flying Saucer

At the moment in Germany, the "curious projects" are being in two, Studebaker-Packard, through Curtiss-Wright would have access to a specialized German development in electrical engine engine falls.

Officers of DeSmet's were scheduled to be held during about 19th considerable expenditure, a Mercedes-Benz 200L sports racing car. Automobile, 1950 lbs, weight, was installed at Hotley's plant in a production shop. It is possible to be the automobile because of speed in selected modified form might mass production of the fuel injection 300 HP, which runs for 5700 rpm.

Hotley expressed himself as much more interested in making money than in developing a big engine. Studebaker-Packard had never lost on net sales of \$450 million. In this connection, Hotley attacked the analysis of independence on defense business for which he blamed a portion that Curtiss-Wright.

Curtiss-Wright, Hotley said, has a reputation of being a leading Studebaker-Packard or of utilizing the capabilities for what defense contracts are available. "The objective is to build up Studebaker-Packard."

"Curtiss-Wright is betting at the store," Hotley said. "The business at the level phase will come from additional expansion. Curtiss-Wright sub-contractors could not expect to lose business."

Nine several other responses died when they approached with Studebaker-Packard. The financial details of the acquisition remain added responsibility (AW issue). Curtiss-Wright is committed to purchase the Aermacchi Development Corporation, specialized subcontract, and leasing of the plants in Studebaker-Packard with \$1 million plant under construction at Santa Barbara, Calif.

It has no option to buy \$1 million

shared shares of Studebaker-Packard company at \$5. The option extends for the first two years of the three-year advance management agreement under which Curtiss-Wright assumes production of the Studebaker-Packard operation.

Hotley said that Curtiss-Wright has even intention of exercising the option when Studebaker-Packard could have (there are 118,000) option, the option and change in par value at the stock price \$10 to \$1 a share. The purchase would give Curtiss-Wright 600,000 shares, though there is a total of 15 million shares, 8,800,000 issued.

James J. Nease has resigned as president of Studebaker-Packard, but will remain as an advisor captain. Harold E. Cheney, non-president as change of Studebaker-Packard, is still second vice. Paul C. Hoffman, former board chairman, has resigned as director.

United, Curtiss-Wright Net Profits Hit \$20 Million for First Half

Financial reports of major aircraft manufacturers for the first half of 1956 continue to bring net profit losses (AW May 12, p. 191) but this one is a good business for its owners.

United Aircraft Corp. and Curtiss-Wright Corp. reported net earnings close \$20 million each and Boeing Aircraft Co. reported more than \$14 million.

United Earnings

United reported a net income of \$18,596,375 or about 65% of 1955, or 199, equivalent to \$400 a share or 19% profit over dividends net preferred stock. This compares with earnings of \$19,302,735 or total shareholders of \$19,098,677 (\$300 a

share) for the first half of last year.

Boeing's contracts, orders and government letters of intent totaled approximately \$2.1 billion in June 30, an increase of \$250 million over last March 31. New contracts and letters in 1956 should approach \$1.5 billion—approximately three times greater than in 1955, the company said. This does not include any of the B-57 or B-77 jet engines on order for the Boeing 707 or Douglas DC-3 jet transport which will begin to be delivered in 1955.

Curtiss-Wright
Curtiss-Wright reported a consolidated net profit after federal income taxes of \$18,452,133 on sales of \$279,141,370, or compared with earnings of

NAA Splits Stock

Los Angeles—North American Aviation, Inc. stockholders last week approved a two-for-one split of its 6 million shares of capital stock. The split becomes effective tomorrow.

The stockholders also approved an equity split-back program, plan, which breaks common shares into preferred shares.

The action, taken at a special meeting, marked the first step in a financing program aimed at providing some \$40 million through an issue of additional shares to shareholders. The money will be used to increase general business and to promote new business. The company's current backlog is \$12 billion, not including portions of new orders not yet fully committed.

\$1,686,839 on sales of \$29,072,134 as the first half of 1958. Approximately half the 1958 earnings came from non-aerospace business. General Wright's backlog now totals \$487,041,900.

Boeing Airplane Co.

Boeing reported net earnings of \$14,468,739 on sales of \$407,354,045 (a return of 3.62%) in comparison with net earnings of \$13,635,938 on \$370,513,714 in sales during the first half of 1957. Net earnings for the first half of 1958 are equivalent to \$2.22 per share on 6,515,768 5 outstanding shares.

Boeing last month announced a two-for-one stock split and has declared a quarterly dividend of 25 cents a share payable Sept. 10 to stockholders of record as of Aug. 29.

Delaware's B&E stockholders to the USAF, advised in the first quarter by "an extraordinary quantity of readable technical equipment," now assumed as the second quarter. Boeing expects to catch up with scheduled deliveries within the next few months. It provided "somehow higher" sales and earnings for the last half of the year. Backlog of backlog sales now totals approximately \$1,807,080,000.

Leer, Inc.

Leer reported net earnings of \$1,077,014 on sales of \$29,756,200. Earnings were 36% higher than the \$678,569 reported for the first half of 1957. Shipments, which set a record, rose \$2.2 million above the figure for the first half of 1957. Earnings represent 41 cents a share on 2,598,471 common shares against 39 cents on 2,547,842 for the whole period in 1957.

New orders booked since the first of the year totaled \$67 million, bringing the backlog to \$62 million less firm orders of 1957 and 1958.

Later in May stockholders approved an

increase in authorized common stock from 5 million to 7 million shares. In place, the company is a position to act opportunistically in the event an extraordinary opportunity presented itself to increase the company's existing capacity.

President Richard Mack said, however, that Leer is not... but is not... in the event an extraordinary opportunity presented itself to increase the company's existing capacity.

The Leer report and the company plans a new manufacturing plant at the Grand Rapids, Mich., airport site. Foreign subsidiaries established last March in Switzerland and Germany now are in operation.

Choco Vought Aircraft, Inc.

Choco Vought reported sales for the first six months of 1958 totaled \$51,354,667 with a net income of \$2,497,962, equal to \$5.35 per share of common stock. Sales for the first six months of 1957 totaled \$49,810, equal to net income was \$1,753,062, equal to \$4.91 per share of common stock. The backlog, approximately 3,267,000,000, provides a total backlog of the F-101 Commander and the Republic guided missile, was reported, as against a backlog of \$214,000,000 at the end of 1957.

Sales and earnings for the first half of the year were affected by the placing out of 170 U-108 fighter jet production and by preparations for production of the B-57D Corsair jet fighter and advanced versions of the Republic, the company said.

Tuome Aircraft Corp.

Tuome reported net sales for the first half of 1958 of \$18,315,317, a 4% gain over the \$17,335,666 reported during the first six months of 1957. Net income was \$1,426,133 after provision for federal income taxes compared with a first half net of \$1,413,790. Stockholders earned first half dividends of 55 cents on 1958 compared with 54 cents in 1957.

Delta, Braniff Northwest Airlines Show Net Gains

Three additional airlines reported profits in financial statements recently. Reports from Delta, Braniff and Northwest follow.

Delta Air Lines earned \$4,087,000 net after taxes for the first six months ending June 30, the airline reported. Previous year's net was \$2,788,000. First 1958 net income included a profit on equipment sales of \$1,489,000 after taxes.

Earning 2,824,884 passengers a record 1,190,247,000 passenger miles—over 35.7% over last year's passenger-miles—Delta also had a total load factor of 82.55% for the year. The airline car-

ried 28,280,215 lb of its freight, 33,488,794 lb of air express and 14,365,795 lb of mail.

Total operating expenses for the year rose \$66,660,000, up from \$59,150,800. Some 125,000 shares of common stock were offered July 11 at \$17.00 each. Braniff reported the offering was successful.

Braniff Airways had net earnings of \$1,006,800 after taxes in the first half of 1958, a 91.5% gain over earnings for the same period last year. Revenues for the first six months rose \$28,028,900, compared with \$21,665,908 in the 1957 period.

Capacity increased 34% to 677,132, 800 available seat-miles in the first half of the year, with traffic increasing 14-15% to 382,301,000. Braniff's President Charles E. Braniff said that the half year results include the cost of introducing a new "Traveler's York service" in February. He said the airline is "re-evaluating" its Chicago route.

"In addition to meeting its direct expense and absorbing its full share of overhead costs, was operating profitably," he added.

Northwest Airlines' profit for the first six months of 1958 was \$2,225,188 after taxes, and operating revenues totaled \$46,495,574. Revenues in the same period last year were \$42,567,071 and operating losses were \$388,000.

Northwest's profit in the first six months of 1958 included income of \$1,219,418 from equipment sales and an insurance recovery on a crashed airplane. Operating revenues for the same period last year were \$42,567,071 and operating losses were \$388,000.

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National Air Show Plans

Oklahoma City—USAF has scheduled 189 aircraft, including the Lockheed F-105 fighter, for participation in the 1958 National Air Show to be held at Will Rogers Field here Sept. 2, 3 and 5.

Chief Curtis says a flight scheduled to be held at the Newell Army Air Station here Sept. 2, 3 and 5 will be the largest F-105 flight to date. The flight will be open to the public for the first time. Highlights of the F-105 demonstration will be a performance by the Danabomber jet precision three team, in the North American F-105C, Super Sabre.

U. S. Marine Corps plans to display about 40 aircraft types, including jet fighters, helicopters and transports. The Navy also will feature the Navy's new jet fighters, the Douglas A-1H Skyraider jet fighter.

Air Force Assn. Demands Single Service

By Claude Wizer

New Orleans—Adoption of a single military service and complete reorganization of USAF's 177 wing goal were demanded last week by the Air Force Assn. in the conclusion of its fourth annual convention here last week.

Clamping that the present status, with a separate Army, Navy and Air Force, "is not efficient, not military, and should admit adjustment to absolute necessity and necessity," the association's 1958 Statement of Policy and Action requested "one no longer an idealistic." The statement concluded:

"The goal must be one program for building national resources in the national defense. We must have one defense plan. We must have a single military service, one chief of staff, one promotion list."

On the subject of air strength, the Air Force Assn. called on President Eisenhower to "reorganize" Defense Secretary Charles E. Wilson to "reorganize the existing force goal of the Air Force and the funding designed to support it and other related programs in the form of a new Air Force department at its funding base."

Quaker indicates that USAF Secretary Donald E. Quarles announced that the military budget cuts will cut the number of wings. He said the administration does not consider 177 wings "a permanent thing" and indicated that 1953 was the start of a downward slide. The Secretary explained that any such change would be due to the increasing potency of USAF wings along with the Army's budgeting ability which would make the "downward" slide.

The Secretary's indication that the USAF may be forced to surrender at least some of its tactical units to the Army was made in a statement given to the convention's luncheon program. Quarles revealed that USAF manpower would be cut in line with administration policy beginning with the fiscal 1959 defense budget. Despite these cuts, the budget is expected to rise substantially higher than last year adopted by the recent Congress with some money being poured into new equipment and maintenance.

In his annual address, Quarles argued that a program in complete cut-back must escape from catastrophe as a new one. He said it is important not to maintain what he termed a "status quo" despite changes in the technology and strategy of warfare. "This comes a time," he added, "in

the course of meeting our answer when we must make a determination of necessity."

Quarles' address upon dedication to present was interrupted by the Secretary, and he stated that the line in fact for budgetary purposes as well as total war. He said that more important elements making up the defense power are "improvements."

Symington Rebuttal

Even before Quarles gave his address, Sen. Stuart Symington (D-Mo.), first USAF secretary and head of the Senate subcommittee on Defense, took issue with the administration viewpoint. He stated that approval is not made up of "intangible" letters and kindly avoided the suggestion of a cutback in the number of USAF wings.

Sen. Symington and Gen. Nathan F. Twining, USAF Chief of Staff, indicated the United States can sustain operations of approval "if a certain number of wings are retained." "I am not to mention USAF planning," the Senator declared, "not planning in the Bureau of the Budget."

Air Force Reaction

Secretary Quarles' open debate of proposals to cut the size of the armed forces and the number of USAF wings was brought to the attention of USAF A-10A wings and military officers present at the convention. The critics extended to men who

are interested possibly in the amount and development effort that is essential to maintenance of qualitative superiority.

Other convention speakers included Gen. Twining, Gen. Otto P. Wiestler, chief of the Tactical Air Command, David S. Smith, USAF assistant secretary; James H. Douglas, USAF under secretary; Edward F. Correll, assistant to the President for civilian facilities planning; and Lt. Gen. Charles B. Stone III, chief of the Continental Air Command.

General Tire Orders Fairchild Friendship

Washington—General Tire and Rubber Company last week became the first U. S. Corporation to order an executive version of the Fairchild F-27 twin turbo prop aircraft.

The contract for the one airplane brand model sales of the F-27 by Fairchild is 27 with options on an additional 25. Delivery is scheduled only in 1958. The F-27 will be operated into the field of its mid-continental route now operated by General Tire and Rubber Company.

The F-27 has been ordered by the head airline. Deliveries are scheduled to begin here in 1958. The airplane will be operated by Frederick Airlines, Midwest Airlines, West Coast Airlines, Frontier Airlines and Denver Air Lines.

Symington 'Man of Year'

New Orleans—Sen. Stuart Symington (D-Mo.), deputy secretary of the Air Force and one-time chief of the Eisenhower administration's aviation policies, was named "Aerospace Man of the Year" for 1958 by the Air Force Assn.

Symington, who assumed the same honor in 1957, was awarded the H. H. Arnold Trophy at the AFA's annual convention. He was chosen, AFA said, for his "dedicated and calculated acquisition into the most important and his 'repeated efforts to achieve sound strength consistent with the dynamic nature of the military requirement.'"

Others honored at the convention included:

- Telecommunications: Arthur Godfrey awarded the H. H. Arnold Memorial Trophy "for distinguished service to progress in the field of Air Applications."
- Lt. Col. Frank E. Everett, Jr., pilot of the Bell X-2 and chief of flight test at Edwards AFB, Calif., was the flight test award for "demonstrating the limits of the conventional jet and contributing significantly to the security of the nation."
- Lt. Col. Charles W. Skowron, University of Illinois pilot and former USAF chief scientist, was the Science Award for "outstanding contributions to the development of a long-range space system."
- Peter Key, Jr., commander, received the Arts and Letters Trophy for "distinguished writing on the Air Force mission that is significant for its popular appeal and its wide base of loyal and responsive."

Key was the author of the script for the movie "Strategic Air Command" and "Twelve O'clock High."

Congress Gives Airpower New Strength

Democratic-controlled Congress pushes airpower program but blocks civil air-safety measures.

By Katherine Johnson

Washington—Congressional prodding that forced the Eisenhower administration to put more teeth into its airpower program was the most notable achievement of the Democratic-controlled Congress which recently adjourned.

On the other hand, the same session of the 84th Congress waded too much time on proposals and aviation investigations.

Congressional activities which shaped aviation in the winter fell included:

Military Airpower

Although the President, in presenting the administration's defense program to Congress in January, emphasized airpower and military aviation, Senate Democrats promptly criticized the Air Force program as inadequate.

The administration program, the President said in his State of the Union message, was designed to "spark the production of the world's greatest military strength." He added that "the development of long-range missiles has been so accelerated here in some time."

Displeased, Democratic Sen. Richard Russell of Georgia, chairman of the Armed Services Committee, called on the Air Force to report just how it would use the \$1.5 billion more than proposed by the administration. At work a year ago, Russell said in the House, "I believe missile field, the most important new weapon the world has today."

In another move, Democratic Sen. Henry Jackson (Wash.) talked for a "manned card" to provide and control only the U. S. missile program. He told a Senate Aviation Investigative Subcommittee, headed by Sen. Stevenson, who appointed its investigative subcommittee's support program.

The result: The administration decided to submit a proposal for \$1.5 billion additional USAF funds but did not volunteer a \$776.5 million USAF increase (including \$240 million for B-57 production), plus \$70 million for possible "emergency" development in the missile program, \$55 million for Army construction of the Davant Army Warning program and \$67.6 million for Navy DEW construction and construction of steps to missile capability.

A costly "test"—Eugene V. McCarthy, former president of EGRO Research and Engineering Co., was appointed Democratic senator upon the Administration's proposal as "better late than never" but it still got caught.

Testimony by top Air Force advisors before the Stevenson subcommittee added up to the fact that the administration's increased program increased "no more." Sen. Curtis LeMay, commander of Strategic Air Command, recommended an additional \$1.5 billion for SAC alone, including \$1.8 billion for aircraft. Lt. Gen. Donald Pitt, deputy chief of staff for research and development, called for \$120 to \$180 million additional for research and development.

In another compromise effort, the administration agreed to an increase of \$150 million in USAF procurement funds and \$100 million for research and development. Democrats, with some Republican backing, insisted on \$500 million additional for procurement.

Result of the Eisenhower prodding: Congress passed the administration's Fiscal 1957 USAF budget providing \$6.3 billion for plane and missile production as compared with the \$7.3 billion requested by the President in

January and \$730 million for research and development (as compared with the \$610 million originally proposed by the President).

Renegotiation

Most consequential result of two congressional renegotiations over military aircraft procurement and profits was to focus on lower and equitable practices of Air Force and Navy and the Republic-Indevco deal.

After a year's study of the 72 major aircraft manufacturers, the House Armed Services Investigative Subcommittee said that, in general, it found no concrete profits. It added, however, that profits placed on some individual contracts are higher than they ought to be.

The House Appropriations Committee criticized both the Air Force and Navy for delay in acting. It also urged more on a prototype type and in issuing up letters of intent.

When work has progressed substantially before a contract is signed, the committee protested, the Air Force and Navy are generally obliged to continue it on the contractor's terms.

The committee also complained that by permitting the use of production funds for research and development, USAF and Navy could lose contact



USAF's Flying Nuclear Reactor

World's first aircraft to fly with an operating atomic reactor aboard Convair B-36, now the XB-36. On flight reactor does not power and has power. Convair built reactor in test tunnel at Wright-Patterson AFB. Atomic on XB-36 has 4000 lbs of power and reactor. XB-36 has the same size and some features needed on various of subsequent airplanes from all other. Test published information and photos of the XB-36 appeared in Aviation Week's ARDC issue on August 6, pages 146, 174.

to obtain credit of such development equipment" and then gain an advantage before entering production contracts for the equipment. The committee's investigation is continuing.

The industry, as well as the USAF and Navy, was angry by the House Armed Services Investigative Subcommittee to not probe an executive compensation charged against government contracts.

The subcommittee chairman, Rep. F. Edward Hebert (D-Ill.) said he was "stunned" by the executive compensation paid to some of the "smelter" defense companies and proposed that they "find a good book, let themselves or the books will fall down."

"The subcommittee also protested the 'letter of compliance' in the defense companies' allowance policies of the USAF and Navy and called for the establishment of a uniform schedule.

Renegotiation Passed

Although the renegotiation law was passed in Dec. 11, 1956, in the week following the vote there is no change effective of it and its administration in the Renegotiation House. Rep. Hebert termed the law "a lousy-headed measure which creates more to be added to demand for it but will be charged with wanting to pay excessive profit."

From the extensive financial data supplied by the subcontractor in the 72 aircraft companies Hebert said he built to understand why the board should meet and assist other.

Sen. John Sparkman (D-Ala.), chairman of the Small Business Committee,

called the renegotiation measure "selective protection without rate from which there is no available or practical avenue of appeal."

Government Information

After several months' study, a House subcommittee headed by Rep. John Nuss (D-Calif.) reported that "a paper curtain has been, almost unapologetically, descended" blocking the flow of information from the government to the public.

The investigative subcommittee, "The subcommittee's initial actions against, was unanimously approved by the full Government Operations Committee charged on the Department of Defense at having "the most restrictive and most involved public information organization within the government."

Commercial Aviation

Congressional pressure also influenced the administration's attitude on two key commercial aviation matters.

Airline Fines. Under the Civil Aeronautics Board (CAB) Administrator Robert Vance voted to institute an investigation of trunk airline fines.

A study by the General Accounting Office for the Senate Commerce Committee had led the CAB investigation. CAB hearings before the House subcommittee subcommittee. Congressmen demanded Board action in 1953 when a proposed investigation was vetoed down.

Delayed Negotiations. Civil Aeronautics Board members agreed that regulations of affected airlines should be performed in negotiations of bilateral agreements with foreign airlines also. Senate Commerce Committee hearings favored on the lack of industry participation in the negotiation of the U. S. Geneva bilateral agreement.

Legislation likely requiring industry participation was unanimously approved by the Senate Commerce Committee and the House in the closing days of the session.

That was not true enough for the House to act on the measure, but the measure, not political action by the Senate is a strong statement of congressional preference.

In addition, the measure would have made CAB decisions on treatment rates easy final and restricted the President's authority over international trade rates to certain offerings, "without delay" and "foreign policy." These restrictions were an outgrowth of the West Coast Florida Case in which the President had unilaterally reversed CAB's decision. Later, under congressional authority, the President was forced to restore.

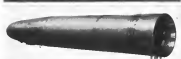
Where Congress Failed

On other matters, Congress was ineffective.

Although several air safety measures including one which would have included first-class laws aspects of care with a prohibition of over the cultural and numerous investigations of the air navigation system were introduced,

Fiscal 1957 Aviation Appropriations

	308,980 (modified)	Approved	F Y 1956
	Aviation	Aviation	Appropriation
	F Y 1957	F Y 1957	
Air Force	\$15,666	\$16,900	\$14,745
Purchase of Public Works			
This includes:			
Aircraft and Related Procurement	6,040	6,045	6,326
Research and Development	430	739	919
Naval Aviation	2,540	2,594	1,515
This includes:			
Aircraft and Related Procurement	1,733	1,735	966
Naval Aeronautics Administration	105	245	160
This includes:			
Development of Air Navigation Facilities	308	85	16
Civil Aeronautics Board	383	284	56.9
This includes:			
Administration	47	45	44
Airline Subsidies	335	161	32.5
National Advisory Committee for Aeronautics	787	750	71.3
This includes:			
Administration	647	628	60.1
Construction	15	14	12.6



Ramjet Drives Missiles

Based "Thor" swept down two British missiles reported to be in production by Bristol and English Electric. Starting reliability is claimed to be 100% and thrust equivalent to the fuel volume is better than any American design. Thor's clock governing nose cone and tail fin holders are driven by the light of combustion or gases taken by air being drawn around a fuel booster rockets (these burning not immediately after separation (boost). Shock front is visible ahead of booster and two shocks can be seen on the nozzle. Envelope of the swept (boom) is characteristically close and simple. Over 200 Thor powered test vehicles have flown from the missile range at Abingdon, Wiltshire and Woomera, Australia. The missiles have been demonstrated in flight because their range are great enough to carry them outside the restricted firing area.

Rockets Boost Napier Ramjet Test Vehicle

Technical details of the British Ramjet altitudinal rocket having Napier NRJ 1 (AWG Oct 24, 1955, p. 51; Mar 26, 1956, p. 55) have been released by the Napier company.

Eight solid propellant rocket motors mounted in pairs on the sides of the vehicle accelerate it to the speed necessary to start the engine. Each booster pair is fitted with a large stabilizing fin, the top chord of which is 50% larger than the root chord. The fins lagge for an accuracy because the center of gravity of the vehicle is located far aft before the separation of the boosters.

After burnout of the rockets the vaporized booster assembly disintegrates at the boost end and is ejected away from the vehicle by small outward firing fins.

The four stabilizing fins of the ramjet stage are made of a wooden frame clad with light alloy.

An inverted-sloped center body divides the four leading fins into a square-planar diffuser duct. The cone body contains a pitot receiver, static-pressure transducer, fuel tanks and components of the fuel system.

The NRJ 1 is approximately 20 feet long and 15 inches in diameter. Fuel volume is:

Pratt & Whitney to Add Some 3,000 Employees

East Hartford, Conn.—Pratt & Whitney Aircraft will hire approximately 3,000 new employees before the end of the year mainly to meet expanding production of jet jet engines.

As recruitment schedules are filled, the company expects to begin the new year with 40,000 employees in its various Connecticut facilities.

Wright A. Perkins, general manager of P & W, attributed the new employment to the "outstanding success" of the J57 jet engine and the scheduled future use of the J35.

News Digest

British Research CANBE referred to England's latest English. Significant tests were made on modifications of British hydrogen engine to prevent combustion fluctuation. Results are being analyzed. Preliminary testing indicates following a "total tank" of several hours on reaction of hydrogen.

Telomex, Inc., purchase of Geophysical, Inc., Danbury, Conn., is listed



**Convair's Atlas...
a key to
ultimate peace!**

A TOP PRIORITY PROJECT OF THE U. S. AIR FORCE

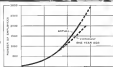
Convair's intercontinental ballistic missile, a vital weapon for our national security, is aptly named Atlas. As a deterrent to war—a force for world peace—it literally can sustain the future freedom of all mankind!

For six years Convair's Engineering to the Rib Power has led the way in the development of the missile. Today, Convair continues its leadership with the largest and most experienced organization in the aerospace field. **CONVIER-ASTROSCOPE** is now building a complete facility in San Diego, California, to produce the Atlas—a key to ultimate peace!

CONVIER
CORPORATION

PROGRESS REPORT

After Thirty-Four Months...



RESEARCH AND DEVELOPMENT PERSONNEL. The above curve shows the growth in Ramo-Wooldridge personnel which has taken place since our Progress Report one year ago. A significant aspect of this growth is the increase in our professional staff which today is made up of 115 Ph.D.s, 208 M.S.s and 263 B.S.s or B.A.s. Members of the staff average approximately six years' experience.

FACILITIES. Within the past five months construction has been completed in our Arden Vista complex, which now contains eight modern buildings of 193,600 square feet in area which are situated in the bottom of the year. Nearby is the B-W Flight test facility, including engine, shop and laboratories, located on a 7-acre site in Inverness, Arden.

To provide additional space for our continuing growth construction has been started on an even bigger 48-acre Research and Development Center, located three miles from the Arden Vista building. The physical site alone is of a model of the Center, which we believe will be one of the finest research and development facilities in the country. The first three buildings, now under construction, will total 210,000 square feet.

A second major construction program is under way on a manufacturing plant for quantity production of electronic

systems. The initial cost of the plant, located on a 40-acre site in suburban Denver, Colorado, will be completed next spring and will contain approximately 150,000 square feet.

PROJECTS. Our current military contracts represent a broad range of advanced work in the fields of missile communications, optical computing and data processing, fire control systems, communications and test equipment. In the general aviation field, Ramo-Wooldridge has achieved design and contract engineering responsibility for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. Our commercial contracts are in the fields of electronic systems, instrumentation, and data processing. All this development work is supported by a supporting program of basic electronic and mechanical research.

THE FUTURE. As we look back on our first three years of corporate history, we feel much to be proud of. At wide variety of technical challenges, contracts have come to us from the military arm and from business and industry. We have been fortunate in the area and vision who has selected us just as in the rich areas of building a company. We are especially happy about the air-minded atmosphere and atmosphere in our management atmosphere with it. We have learned much from the really essential support of our operations. We plan to keep going to meet the fact that the continued success of The Ramo-Wooldridge Corporation depends on our maintaining an operational program of professional environment and methods of operating the company that we mutually will attend to the special needs of the professional society and engineer.

The Ramo-Wooldridge Corporation

1957 AMERICAN YEAR BY • LOS ANGELES • CALIF.



ity by Teledyne toward production of a combination engine and automobile. Constructed by Boeing prototypes of CAA certified "Aquila," but never has gone into full production. Teledyne has an immediate production plan. Buehler was made with Teledyne stock.

Additional M-21C Varsity helicopters have been ordered by Army under \$24 million contract awarded by USAM.

B. F. Goodrich Co. control a separate organization, B. F. Goodrich Aircraft Products, P. W. Perkins is general manager.

Minister for Civil Aviation for Australia, John Lowrey, said bilateral air transport agreement between Australia and Germany has been reached. When signed it will enable existing Australian surface operations conducted by Qantas Empire Airways to London through Frankfurt. It also will extend reciprocal rights to a German flag state airline to operate from Germany to Sydney.

Associated V-4 engine carrying 70 lb of aluminum in total weight of 100 lb., is certified as powerplant for subsonic military aircraft. Engine developed by Aluminac Company of Montreal and Aluminac Motors, this project is directed toward subsonic V-4's.

Order of \$23 million for electronic bombing systems and gun launch rocket sights issued to AC Spark Plug Division of General Motors. The division also is developing an aerial guidance system for an advanced USAM missile.

Westinghouse tells largest production, double production, over built but has been ordered by Bell Aircraft Corp. Buffets for comprehensive electronic testing of guided missiles and small aircraft. Shell measures 40 ft in length 75 ft width, 35 ft high.

General Dynamics Corp. will design and build world's largest supersonic wind tunnel valued at \$3.5 million. Contract let by U. S. Army, Corps of Engineers to be at Langley's Arnold Engineering Development Center in Tidwell, Va. GD's first Division at Greenville, Conn., will execute contract with a subcontracting, Strategic-Curtain of Rochester, N. Y.

Avco will send 199 aircraft to participate in 1955 National Aircraft Show at Oklahoma City, Okla., Sept. 1-2 and 1. Included are Lockheed P-104, North American F-100, McDonnell F-106, North American F-100C and Boeing B-52.



Caravelle Survey

First Boeing B-70 Caravelle delivered to Air France last week between Paris and Montreal. Air France is conducting an extensive operational survey with the two-seater jet airplane previously to beginning regular passenger service with a fleet of 12 Caravelles late next year or early in 1958.

Boeing is looking through a forward door in fuselage. Passenger entrance is through the bulkhead to rear fuselage. Steps are an integral part of the door. Rolls-Royce RB 75 Avon engines are mounted on either side of the fuselage at rear. Caravelle cruises at 410 knots at an altitude of 50,000 ft. With a payload of 25,000 lb., second stage is 1,020 thrust only.



Eyewitnesses Describe TWA-UAL Crash

CAA hearings produce structural evidence of collision, translation of last United message.

By Craig Lewis

Washington—Public hearings on the Texas World Airlines United Air Lines accident over Grand Canyon turned up three possible eyewitnesses to the crash and produced definite corroborative facts that the transports collided in mid-air.

A high level Civil Aeronautics panel of inquiry examined three witness statements during the Washington hearings in an effort to find out just how and why the TWA and United transports collided.

Testimony of the CAA structural investigation group produced evidence that the TWA Super Constellation and United DC-7 collided in flight before they fell into Grand Canyon in the June 30 accident which killed 128 people.

Investigators retrieved wreckage from both planes. Examination showed that the left main wing of the United DC-7 made contact with the Super Constellation fuselage forward of the tail. It also showed that a DC-7 propeller or propeller blade was on one side of the Super Constellation fuselage.

Eyewitness Accounts

CAA investigators are still reconstructing material from the accident in an effort to determine the route at which the two aircraft collided and their positions when they collided.

At the hearing, the CAA called three separate witnesses. They all testified the investigators first saw the collision while driving along U S Highway 66 near Grand Canyon.

Mr and Mrs Eugene J. Siferle said they saw two aircraft appear in a bank, between two large obelisk structures in the Grand Canyon area. They said the aircraft collided, they remained locked together for the few seconds they remained in view. Siferle said the planes were a Constellation and a DC-7.

The Siferles said they were a few miles out of Flagstaff, Ariz., when they saw the accident. They asserted that the planes appeared between two large, obelisk shaped structures, one of which was very dark. Siferle said it appeared that the two planes may have flown around opposite sides of the obelisk formation before they met.

In a few days of hearings, the investigating board held repeatedly to

Julia Siferle's story, but he remained unconvinced that he had seen by aircraft collide over Arizona on June 30.

Two witnesses from West Virginia, Mr and Mrs Walter J. England, came on Highway 66 west of Weirton, W. Va., about the same time. Mrs. England said she saw an explosion in the air while watching some heavy cloud formations in the Grand Canyon area.

Puff of Smoke

About noon on June 30, Mrs. England said a cloud formation grew very rapidly over the Grand Canyon. As the cloud grew larger, it grew darker, and Mrs. England said she saw lightning in it.

"And then all at once," she said, "I saw a great puff of smoke appear, and I kept watching, and it spread out just like a parachute was opening up. And, then I began to see something coming down out of the sky and beside following after it, and it came on down until it got behind the clouds, and I couldn't see it anymore."

Mrs. England said the object was an airplane. At that time, she thought it was a jet aircraft. She said she continued to watch the smoke cloud and the falling aircraft. "In a good five minutes we would have seen it."

Both the Siferles and the Englands told the CAA panel that they had failed to realize the significance of what they saw until they learned of the recent loss. "Nobody could suspect what they saw until after they realized the cause because they feared they would be deluged in the West."

Uncontrolled Ascent

Testimony of communications and traffic control personnel involved in the TWA and United flights showed no apparent irregularities in the way the two flights were handled. The flights collided in uncontrolled airspace in an area where the Civil Aeronautics Administration has no responsibility for regulating traffic.

Both flights left Los Angeles under instrument flight rules. They were scheduled to depart 15 minutes apart, but some mechanical troubles delayed both flights, and they actually departed five minutes apart.

When the TWA flight asked to change its altitude from 19,000 ft to 21,000 ft, the request was denied be-

cause the United flight was at 21,000. TWA got permission to fly 4,000 feet up the climb. Both flights left the airport—and CAA responsibility—when they crossed the tower approximately at the California border.

CAA officials explained that traffic controller advised to allow the two aircraft to cruise at the same altitude in California because they still had to cross as they flew before they crossed into uncontrolled space in Arizona.

The CAA witnesses explained that no traffic controller would so attempt to provide an advisory service in uncontrolled airspace. They said the TWA flight was advised of the United flight's altitude as an explanation for refusing the request for 21,000, not as a warning of possible hazards. Under this policy, the United flight would not be advised of the TWA traffic.

No CAA Advisory

CAA controller Loren H. McCrory of the Salt Lake City center was responsible for the sector in which the crash occurred, but he pointed out that he was responsible only for the airway on the sector. He said controllers keep track of aircraft flying through uncontrolled space primarily to plot the route and place where they will cross the airway system.

McCrory said he knew that both the TWA and United flights were at the same altitude when they left regional and that their courses were plotted to cross. He pointed out, however, that the pilot was on their own and could change their course and altitude at will, and, therefore, CAA does not provide any advisory service in uncontrolled areas.

"Normally," the controller said, "we workload in such that it makes it impossible to provide that type of advisory service...with the facilities that we do have."

A fragmentary radio message from the United flight was received at Salt Lake City at the time the two flights collided in uncontrolled airspace over the Painted Desert.

CAA controllers were unable to determine it at first.

'We're Going In'

Careful replaying of the recorded message indicated it was "We're going in 710—We're going in."

David D. Thomas, director of the CAA Office of Air Traffic Control, was asked if he could hear it all as he listened the flow under instrument flight



First Britannia, Viscount, Flights

Boeing 707 prototype (top) takes off from El Paso Airport in El Paso, under flight program, to be used in production of new 300-000 series. Its 124-ft wingspan, 83-ft length, 36,000 lbs. max. take-off weight, 7,000-hp turbojets, 100-100 seats, an air-side Viscount 802 or 90 series, under flight program. British European Airways has 24 802s on order, 802 is powered by four Rolls-Royce Dart B. 50s, subsequent Viscount 800 will have B. 50 engines.



rules on the federal service. He said the CAA cannot accept and handle all of the traffic.

"But, I cannot object, there would be something in terms of delay, in terms of coordination and the fact these communications which are now coming across in the air, efficiency area." He said the CAA is now working to protect the situation, and that the takeover of the Everett federal airspace plan into there is a step toward solving the problem.

Members of pilots flying in the general area of the accident indicated that a large cloud formation was building up over the Grand Canyon at the time the collision occurred, and that the top of the formation was near 25,000 ft.

United States Army and Air Force helicopter pilots told the investigating panel of the difficulties they experi-

enced in reaching the area of the two wrecks. Helicopter crews said 75 mph into the canyon caused disorientation and removing bodies and pieces of the wreckage. CAA Chairman James H. Doolittle, expressed the panel's appreciation to the helicopter crews and said "it was an heroic operation."

They are here presently with a fleet of Model 35 Beechcraft, making next to the U S and Canada.

Beech Flight Tests New Executive Plane

Wichita-Beech Aircraft Corp. last week began flight testing a new four-place executive aircraft which it hopes to place on the market soon next year.

Having an external cabin door is the six-place, 17-wp Beechcraft and designed to compete with the Cessna 440 (AW July 16, p. 30). The aircraft has been designated the Beech Budget. It will have a cruising speed of 200 mph and is being put through an accelerated flight test program.

The Budget, powered by two 150 hp Lycoming O-360 engines, will sell for between \$15,000 and \$15,800.

Airline Traffic—June 1956

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Pct. Cont. Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	243,692	452,535	79.08	1,672,498	247,008	8,602,679	32,900,543	65.12
Boeing	174,538	341,296	66.17	919,510	192,271	303,497	8,848,340	38.21
Capital	10,219	20,252	59.91	56,216	12,176	29,216	15,165,286	35.91
Continental	68,524	136,023	51.92	71,879	17,420	100,639	2,411,919	48.39
Delta	304,995	581,418	68.20	1,948,601	313,077	892,684	12,450,317	66.40
Eastern	181,219	351,522	65.91	1,191,541	202,035	1,179,491	18,097,139	55.91
National	103,115	206,217	14.64	309,308	48,213	219,365	1,790,181	71.71
Northeast	139,812	279,624	59.20	1,068,208	192,271	75,628	2,282,429	46.20
Northwest	134,038	251,148	71.82	386,428	76,377	600,742	10,575,639	65.20
Southwest	104,113	208,227	76.47	523,300	102,026	1,192,345	13,518,347	69.91
United	314,832	646,232	71.21	1,371,283	278,711	4,787,559	56,981,125	58.26
Western	92,008	182,394	67.48	531,373	71,487	171,770	3,214,680	66.23
INTERNATIONAL								
American	17,202	7,699	44.24	11,333	079	999,643	1,299,753	65.96
Boeing	12,513	5,795	50.69	16,275	—	75,481	748,544	34.44
Canadian Atlantic	13,164	1,614	52.84	1,520	—	6,267	24,647	17.60
Delta	4,881	1,838	68.89	6,763	—	39,613	648,670	31.91
Eastern	97,311	14,389	19.64	11,714	—	3,028,644	3,028,644	66.21
National	4,543	4,416	51.31	6,112	—	11,252	80,491	48.03
Northwest	17,202	20,489	66.32	109,138	30,817	97,289	4,856,736	73.16
Pan American	8,890	3,851	71.31	40,611	—	401,391	1,438,508	63.33
Republic	108,991	133,693	64.18	161,754	—	1,769,508	16,675,481	66.47
Trans World	68,867	113,584	70.11	1,078,734	—	1,767,111	16,718,862	71.81
Varadero	414,366	538,414	66.30	351,000	—	3,706,817	13,517,914	68.08
Western	11,369	12,746	56.10	30,797	—	80,259	1,718,377	34.27
United	25,124	33,719	15.27	169,368	—	718,614	10,146,794	71.81
United	16,380	30,711	67.81	103,393	—	61,990	3,307,338	60.27
LOCAL SERVICE								
Allegiance	48,423	7,342	41.23	1,240	18,432	8,023	712,823	47.92
Allegiance	17,692	3,868	48.74	3,354	3,354	1,784	276,152	53.82
Central	9,441	1,346	36.01	4,516	1,159	5,361	178,451	38.33
Frontier	16,326	2,329	40.28	11,717	7,684	67,090	493,473	56.91
Great Central	10,133	6,636	63.51	8,711	—	18,114	1,068,768	66.21
Midwest	34,739	5,517	40.80	3,426	5,287	18,536	817,619	36.82
North Central	33,417	6,462	38.99	19,201	99,929	—	1,011,401	47.21
Northwest	40,462	4,432	41.28	10,009	74,330	5,143	476,811	59.00
Southwest	15,736	3,653	27.96	6,248	1,567	16,433	675,361	47.41
Southwest	87,017	7,379	32.40	8,276	4,173	7,672	530,809	30.84
Trans World	79,056	4,536	48.18	14,803	9,172	99,297	476,199	37.84
West Coast	80,148	3,379	37.90	4,518	3,779	5,431	315,313	54.91
HAWAIIAN								
Hawaii	45,361	5,423	63.12	4,296	—	115,313	660,000	58.42
Trans Pacific	24,683	2,738	35.48	848	—	17,764	248,568	51.80
CARBO LINES								
Allegiance	6,669	13,774	99.47	33,832	29,882	193,088	682,098	61.81
Allegiance	4,073	17,391	99.91	36,934	30,829	4,834,660	6,811,935	76.15
Boeing	—	—	—	—	—	—	—	—
HELICOPTER								
New York Airways	4,373	—	68.66	—	1,369	537	10,492	64.87
Los Angeles Airways	—	—	—	—	7,795	—	2,795	44.26
ALASKA								
Alaska Airlines	4,367	8,263	39.09	46,377	—	673,446	940,838	30.72
Alaska Coast	3,321	491	36.68	4,661	—	4,781	38,841	61.22
Eyes Airline	2,323	30	17.64	212	—	957	4,817	71.88
London	1,970	849	34.40	1,819	—	799,231	225,509	50.69
Northwest	1,076	316	31.43	1,873	—	1,499	64,799	64.64
Northwest Consolidated*	—	—	—	—	—	—	—	—
Pacific Northern	14,838	17,365	64.30	70,689	—	302,194	1,611,796	68.34
Trans Alaska*	—	—	—	—	—	—	—	—
Wash. Alaska	4,066	7,792	14.94	48,519	—	1,371,397	1,915,361	63.87

*Not available
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



Showcase for Western Transports

Lined up on the ground at Vancouver airport outside of Moscow (above) are Boeing western transports. They are (left to right) Douglas C-119 (DCC-48) that brought Gen. Nikita S. Khrushchev and party to Moscow; de Havilland Comet II that served the Royal Air Force (above), and a French Farman. A Boeing built 1/2 that resembles another famous Western transport is at the extreme left, and its plane Russian units in the background. Later the Russians ordered a Tu-104 over the horizon, refueling tankers crossing the Western air space. Check out the D-18 (below) also a product of Vancouver. Note it carries Russian-made transport fuel that is added, according to the caption.



Argentina Sets Out Policy on Airlines

Recent Aero-Argentino has decided to continue the negotiable extent flights of her national airline, but she leaves the door wide open to one Argentine private company that would like to take over some of these services.

This decision was revealed in a document concerning the whole field of commercial and civil aviation. In the line of the Ministry, one of the three military commands, occupying a sole line of Argentine aviation.

The law states in part: "The State, through its companies, will continue to operate international air services, but the National Govern-

ment may authorize operations on overseas routes of Argentine private companies, in accord with rates to be laid down by the Ministry of Aviation."

Domestic flights will be made only by Argentine companies. The Federal Government may authorize private companies to operate such traffic with one exception, however, in the eventual development of traffic to the Antarctic continent.

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Scandinavian Airline to Study Northern Lights

Stockholm, Sweden-Northern Lights will be studied and photographed in connection with the 1955-56 Geophysical Year from planes of the Scandinavian Airlines System on the Stockholm-Tokyo Polar route which will open in February 1957.

A special northern lights camera has been designed for this work by W. Stalfregen, an engineer at Uppsala Spherule Observatory. Apparatus makes it possible to photograph automatically the aurora borealis every minute during dark hours. Air photographs will demonstrate brightness of aurora from various latitudes, represented at arbitrary points.



This is a cam characterized potentiometer, one of several in Honeywell's advanced MB-3 Autopilot. By scheduling circuit gains as functions of the basic flight control parameters, these Honeywell-made precision potentiometers help make the aircraft behave at supersonic speeds. The pilot gets the aeronautical equivalent of power steering: he applies the same stick force for a given maneuver, regardless of the aircraft's speed or altitude.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

Future Uncertain for Idlewild Loadair

New York's plan of the \$899,000 Whiting Loadair installation at New York International Airport (NY Jan 12, 1975 p. 83), still runs after a year and a quarter.

If orders of the long-awaited use to use the mechanical aircraft docking system during the rest of the life of Idlewild is temporary terminal, certain modifications are in order. If an agreement for further use is worked out between the airlines and the Whiting Corporation, the rest will be removed.

Whiting installed the Loadair in December, 1975, specifically for a test to test under a three-way arrangement between Whiting, American Airlines, and the Port of New York Authority. The manufacturer says it got what it wanted in the way of information from the trial, and would not start its routine operation of the device without the modifications. The airlines feel that Loadair needs improvement to offer possibilities for the future.

Industry Interest

The experiment drew considerable interest and pointed up industry assessments that new powered landing methods are needed to keep up with other developments in commercial aviation on the threshold of the jet age. The test in some respects was unconvincing, but it demonstrated one obvious fact: airlines passengers appreciate being kept out of the wind and weather.

Some 1,500 flights involving seven

airlines were handled by the Loadair at Idlewild during its operation there, according to the Whiting Corp. Airlines officials gathered by Associates Whiting agreed that their passengers liked it. It was an unseasoned standstill, there were some criticisms.

Loadair consists of an elevated landing deck and six tracks and machines which bring an aircraft sideward against the track and pull it out again. The aircraft positions itself so that its main landing gear rests on rollers on the main Loadair track, which are raised to allow the aircraft to sit on a low-rolling dolly not powered by cables. The installation included several sets of mechanical tracks to accommodate different types of aircraft.

At the passenger airplane, aircraft from several doors to control deck, their baggage trunks by conveyor to a self-drive area at the rear of the elevated surface leading to the dock.

Active people, spots of problems with the test Loadair model, including the following:

- **Fixed chocking of the aircraft wheels in the deflex.** Chocking was accomplished by moving a lever with aircraft power. Whiting plans a hydraulic drive system for future models.
- **Fuel spillage onto the bench** containing the cables. To eliminate this hazard Whiting has designed a carbon dioxide purging system for the bench.
- **Stow and tie in the trench.** This was solved in the Idlewild installation by

electrically heating the main gear trench.

Nonstandard trails were cleared by hand.

• **Stow in the nose wheel stow.** In some cases, the nose wheel stow protruded and became a tripping hazard. The nose wheel stow was "bumped" off the front track was corrected. Whiting says the front dolly could be powered if necessary, but probably then, not really that much stress on the stow.

• **Inefficiency of dismounting** used nose gear at the dock while the plane is raised out, then connecting power equipment again to start engine. Whiting says this problem could be corrected by hydraulic tracks at each end of the track or by starting engines at the dock.

Later actions would require the repositioning chocking system for safety.

Valuable Experience

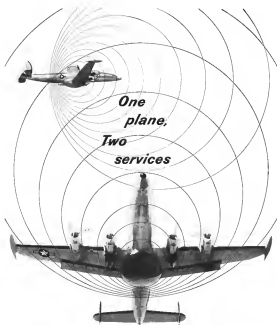
The manufacturer considers the test run as valuable experience, and is proud that faults can be corrected. The Idlewild test suffered some breakdowns, which Whiting says was 70% changeable to the check system, 15% to the electrical system, 8% to the drive cable system, 9% to the nose wheel track boardman. All of these items except the chocking were corrected by 50% modifications.

Whiting paid for the test installation and its operation, allowing them, airlines checked out in six days, to operate the Idlewild line. American Airlines agreed to the operation in the airlines.



New York's Plush S-58C

The converted S-58C displayed at LaGuardia Airport by New York Airways is expected to go into air-rigging service by Labor Day. It will carry two more of the 42-passenger Sikorski machines within a few weeks, a fourth only next year. Recently introduced in Civil Aeronautics Administration (CAA) will carry passengers in two air-seater configurations. Probe, hazard and plusher than five-passenger S-58C, now operated by NYA, S-58Cs will be fitted with modifications for service into Manhattan by early 1977. New York Airways can handle 3,000 lb of useful load, climb about 3,000 fpm and be powered by Wright R4430 engine developing 1,133 hp.



In this picture you can even see the member wings which decrease a wing span, the vital rule of maintaining our air line flow line of aerial delivery for your customer in the Lockheed designed and built rubber plane planes—the U. S. Air Force's KC-121D and the U. S. Navy's WV-2.

In darkness and fog, in icy weather and hail, these twin rotors opening forward the rotors and the cowl, at a lift-off up to 23,000 feet and at speeds up to 340 mph. Pressurized and air-

conditioned, they provide 15-degree cabin comfort for a 16-man crew, even when outside temperatures are 80 below zero.

The entire fuselage assembly in the belly section of these great planes was developed by Lockheed—existing from 10 order forms in more than 41,400 standard square miles from 1940-0-0, worldwide.

Only Lockheed provides low-cost, AEW plane—aircraft to the all-weather capabilities of the KC-121D-WV-2, and to Lockheed's leadership in the early training electronic systems field.

Lockheed

AIRCRAFT CORPORATION AIRPLANE, CALIFORNIA Lock in Lockheed for Lockwork

tional area, and the Port of New York Authority shared the expense and helped in planning it. American National, Trans World, United, North west, Panagra and Air France used the device to varying extents, Whiting reports.

Regular landing reports of the Lander was watched with interest, but again further modifications are indicated. Work is now done on the system watched and passengers found their legs waving at the end of a short walk, the data and the experimental steps was found too small and clear sometimes occurred.

Feet Approach

Lander approach one of four approaches to the position of passengers and their luggage from the doorway and other kinds of the ring. Officers mobile, covered "bridges" to connect the gate position with the aircraft door, including of the end of the terminal stack which covers result period of the gate position, special vehicles to transport passengers from terminal to plane (AW June 18, p. 102). The third kind of the Lander type also could be equipped with integral servicing facilities.

A disadvantage is its active reference. The unit could handle the DC-4, DC-6, DC-7, Stratosphere, Constellation series, Convair and Martin.

It could be, for example, handle the Viscount without modification.

Weight No Problem

Also, would a weight of 270,000 pounds per jet such as the 707 be too much for a Lander installation? First, according to Whiting, if the unit were designed for it. The weight, says the firm, is no serious problem. They have built related machines to handle much heavier equipment.

As to the weight load, says Whiting, says, the 707 and the DC-8 could be brought straight into the dock like conventional aircraft, with the wing fitting snugly between two passenger fingers, and the front and rear access doors opening the docks at the end of the fingers. Or a servicing plane could be brought to contact fuselage with an extra wing track for one set of the nose wheel. In that case, one dock could extend further than the other to accommodate the front approach dock, according to Whiting's proposal.

The company, the firm's additional all-weather aircraft. A cargo air carrier is still in the planning stage. A cargo air carrier has been operated by Airlines at Birmingham, Colorado, since 1951.

The Whiting Corporation is optimistic about the future of its Lander approach inside air as the design stage, the firm says, and negotiations are under way with "several" other prospects.

AIRLINE OBSERVER

► Highly-centralized New York-Florida One should be studied by the Civil Aeronautics Board by mid-September. Quoted piece of Northeast Airlines has taken a similar one with reports that the CAB has the order for the latter's Miami-New York route. Most of other leading applicants at the time, Capital, Delta and Pan American, have remained steady.

► Amda's international service closely reflects Khrushchev policy changes. A year ago, when Yugoslav Minister Tito was still at odds with Moscow, Amda's ran one weekly air-service flight to Belgrade. Now, with Tito back on the Cominform fold, Amda's operates two weekly roundtrips between Moscow and Belgrade. The airline recently established a special weekly featuring Soviet and Yugoslav flags on the coast. Roundtrip fare for the 2,100-mile flight between Moscow and Belgrade is \$215.

► Continental-Capital merger proposals have been shelved because of the present financial strength of both companies had been increased by Lehman Brothers, who brought J. H. Cassaday and Robert P. Six, respective heads of Capital and Continental, together on at least two occasions. The Wall Street investment house wanted to buy a majority in the grounds that it would allow the financial position to face parallelly in both companies.

► Air Transport Association will make its strongest bid yet to have both the Republicans and Democrats adopt electronic plans embracing the airline industry. An expanded staff of ATA officials and legislative aids will attend the negotiations to make the program. Republicans adopted such a plan in 1944 and 1946; Democrats in 1940 and 1952. Never has the industry received platform support by both parties in a single year.

► Reports that Quaker Engine, Airvac can buy the Grand Jet 400 term part are dismissed in Anasida. Quaker likes the Grand Jet 400 but says Bristol will come out with an engine that could compete with Douglas DC-3 and Boeing 707.

► Most of airports in the Washington area are voluntarily slowing a 180 miles speed limit, although High Density Air Traffic Zone restrictions that previously had entered since a limit speed on July 31 after a curfew trial (AW July 16, p. 31). Restrictions probably will be re-established permanently within 60 days, when the Civil Aeronautics Board is expected to engineer the Civil Aeronautics Administration to improve Washington and other areas in passenger load factors. Areas outside Washington to receive the restrictions probably will be Chicago.

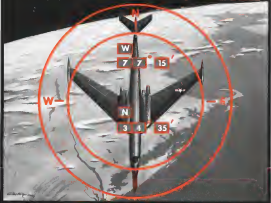
► Detroit now, here, three downtown judgments of the Civil Aeronautics Board and the Post Office Department require rates reduced by the Detroit Aviation Commission. Parts would be engaged to handle both mail and passengers. Three organizations have submitted applications to the CAB for the Detroit service.

► International Air Transport Association is worried about the lack of tourist facilities in Europe. Aeronautics are not helping pure with the volume of transatlantic passenger traffic to Great Britain and the continent. According to the William Haber, director general of International Air Union, the American Air Association, which plans to hold its annual convention in London with 2,800 persons attending, can find back for only 2,800, although a year's advance notice was given.

► Decline in structural applications is apparently behind United Airlines' maneuvering to employ more of its own pilots. United has increased the maximum acceptable height for applicants from the first, seven inches to the feet, eight and reduced the age limit from 31 to 30.

► French Union expanding its traffic control operation has defined "all responsibility in one of a possible, if not certain, accident at Paris-Orly Airport. The hazardous situation, according to the source, is created by an unbalanced control tower. A spokesman for the French government called the tower's chaos "justly exaggerated."

another example of how **RYAN BUILDS BETTER**



NOW! AUTOMATIC NAVIGATION FOR GLOBAL JET FLIGHT

An advanced system of aerial navigation, with the speed and precision demanded by high speed jet flight, has been developed by Ryan under sponsorship of the Navy's Bureau of Aeronautics. Using continuous-wave radar, in which Ryan is a recognized leader, the Ryan AN-67 autopilot will enable fast-flying military planes and future commercial jetliners to travel to any point on the earth's surface with low accuracy and speed. Instantaneous in operation, the Ryan autopilot gives the pilot his position (latitude and longi-

tude), ground speed, ground mileage, drift angle and ground track in continuous, readable form. No computers are necessary. The equipment is compact and self-contained. No ground facilities are employed—no wind information or aerological data are needed. This significant contribution to jet navigation is typical of the work which Ryan and the military services are accomplishing in other fields of electronic research such as supersonic missile guidance for the Air Force and helicopter hovering devices for the Navy.

Electronic engineers will find a challenging future with outstanding opportunities at Ryan.

With a background of 33 years experience in aviation, Ryan excels in designing and producing high quality aircraft, power plants and avionics, built at low cost, delivered on time.



BEA Carries 12 Million Passengers in Decade

London-British European Airways has carried more than 12 million passengers, carried 510,000 tons of mail, and produced 635 million ton miles of aviation, according to the airline. BEA which was at its largest earlier in Europe and the world largest in Europe before operations in August 1964.

BEA claims to have introduced the world's first scheduled passenger jetliner service in 1950 between London and Cardiff. Walter First party got one of the Victor Vancos also is claimed by the airline with first scheduled in 1945. BEA since has flown more than 100,000 hours with its Vancos and carried a million passengers in their airline reports.

Shortlines

► **Airline Closing**—Howe handled in 6 days losses worth \$38,774,927 in loss, an increase of 30% over June, 1957.

► **Air Transport**—Ann estimates the scheduled airlines carried three 50th million passenger on July 29.

► **Boeing's airline** strike was called after a hot check-out on trial for a week. Airline crews called for a 50% raise in pay, but the Labor Ministry called the strike on the basis of a voting scale of increases ranging from 3% to 6% based on 1957 values.

► **British Overseas Airways Corp.** will increase its New York-Norfolk service from two to five flights a week on Sept. 7. All flights will be served class in Victor Vancos equipment.

► **California Eastern Airman** reported operating losses of \$16,650,374 and net earnings after taxes of \$474,869 for the first half of 1958. In the first six months of 1957 the company's income was \$11,992,261 and net profit after taxes was \$275,867.

► **Comair** has set orders for 25 Metropolitan 440. Scandinavian Airlines System has bought five more 440s, bringing its total order to 16, and Braniff has ordered three more Metropolitan for a total of 11. Eastern Air Lines and Delta Air Lines have each ordered three more 440s, and the Air Charter Service Corp. has ordered two of the aircraft for use in Japan. Lincair and Transair airlines each ordered one 440. Lufthansa bought two and the

COCKPIT VIEWPOINT

By Capt. R. C. Robson



Boeing 707 Impressive

As the new picture on this column is supposed to show, I am now a jet pilot. At least I've a few hours and one landing and take-off worth a jet pilot. As one of a group of American Airlines pilots, I recently had the opportunity to fly the Boeing 707. Some members of the group had had considerable experience in jet aircraft, from P-51's to B-47's, and it was interesting to note that their reactions were not a whit less enthusiastic than mine.

Perhaps the highest praise a pilot can give an airplane is that it is "innocent" step. The 707 fits the bill. It is stable, smooth and easy throughout the complete range of speeds. Control response is firm and prompt from full over stress at 400 mph down to slow speed flight.

Stall is Clean

There is ample warning of an unstabilized Mach number—high wingtip buffet and some aileron rattle, and there is sufficient stall warning. Stall speed with full flaps at 138,000 feet is 95 knots. The stall is clean and not hard to break.

Considering the fact that this is a jet with zero-thrust which in its airline version will gross speeds of 210,000 feet and cruise at 400 mph, the flight characteristics are very impressive. Part of the secret of control lies in the experience which Boeing gained in building the 47s and 52s. The 707 has picked from this experience.

The effect of the over-stress was easily demonstrated in a test approach for landing. About four miles out on final approach a wave from the sea wanted to know what would happen if all power was dropped off. Before the pilot had time to react and realize that the aircraft should be on the ground the sea from that approach was a gradual decrease in airspeed no matter how, in pitch was tried to correct.

Once the wave tried to see a sudden full power application. This was accomplished by simply raising the throttles forward. Again there is no violent change or attitude. It's smooth, began picking up speed. I figured that acceleration from slow speed to full thrust takes 4-5 seconds. And it is remarkably smooth.

Spiders Used

These airplanes which I was flying in one of the main brought me to the field a bit high but by using 30 deg. of spoilers, we eased down on a smooth on-glide. Prior to this we had to use the "go-round" in speed brakes and was able to establish a rate of descent of 15,000 fpm, in one minute from cruising speed. The ability of this type of a real "man" for an airline transport maintaining the smoothness of acceleration that is expected to get in and out of some of our airports.

For a large airplane, the cockpit of the 707 is quite small, though not cramped by any means, and all controls are quite accessible. In a workshop of this size a little guy like me can feel completely at home and still have sufficient visibility. Configuration of this type definitely aids the pilot in doing a smooth job.

Naturally with a plane of this size and weight there will be things the big guys load the cockpit on but don't load on our systems as our bodies are built to handle proper operation. Even sitting in the floor pilots. But this could be and for any large airplane, does not detract from the ability of the Boeing.



OPTICS ?

That of American Optical Company... America's Complete Optical Source

In the air, on land, or in the sea, AO designed and manufactured optical systems are the key to an almost endless variety of weapons.

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have been sold in corporate records.

► **Capitola's Kingston Airport** has had 431,714 passengers in the first six months of the year, a 27% increase over traffic during the same period last year.

► **General Parcel Delivery** will operate 5 daily air cargo pickup and delivery services at the Chicago suburban area for American Airlines, Air France, British Airways, Capital Airlines, Delta Air Lines, Eastern Air Lines, Northwest Airlines, Czech Air Lines, Trans Canada Airlines, Texas World Airlines and United Air Lines.

► **International Air Transport Assn.** Clearing Toronto has had 595,620,000 in revenue transactions during the first three months of 1956 a 24% increase over the first quarter of 1955.

► **The Sudan** has become the 19th member state of the International Civil Aviation Organization.

► **Melrose Air Transport** has 7,066-720 km miles of air cargo in the second quarter including 3,154,672 km miles under contract with Military Air Transport Assn. Total traffic in the April-June period last year was 646,671 ton-miles.

► **Mohawk Airlines** will move its head quarters from Ithaca, N. Y., to Orange County Airport, midway between Ocala and Seville. Mohawk's planned \$2 million headquarters facilities will be financed by an Orange County bond issue and amortized by the airline over a 25-year period.

► **Omak Air Lines** carried 20,588 passengers in July, a 23% increase over July 1955 traffic. The local airline carried 175,703 passengers in the first seven months this year and 136,340 in the same period last year.

► **Pelican's national airline** is expected to obtain landing rights at London Airport in the near future.

► **Seahound and Western Airlines** has increased its transatlantic cargo traffic 100,000 lbs in flights to six flights a week.

► **Trans-Canada Airlines** carried 966-135 passengers in the first six months of 1956, an increase of 24% over the 1955 period. TCA traffic on the New York-Canada routes totaled 541,976 passengers in the same 1956 period a 66% gain over last year.

► **West Coast Airlines' theoretical pilot strike** was averted with a new contract that includes wage increases and a pay raise plan.



Actual test firing of a modern ROCKETDYNE rocket engine at the Field Test Laboratory in the Santa Susana Mountains.

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...the REACTOR 160-to-160 surface ballistic missile of the Army Ordnance Corps...and for many other large guided missile projects.

For the past 10 years ROCKETDYNE has been working closely with the Department of Defense, producing its rocket engines as requested, and delivering them on time. New and more powerful

rocket engine designs for tomorrow's more effective missiles are in constant development.

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New Device Automatically Tests Diodes

Auto-Sorter checks semiconductor diodes at rates up to 8,000 per hour, sorts them characteristically.

By Philip J. Klein

The great gains which avionics equipment manufacturers have long pined to get semiconductor diodes tested in their specific circuit requirements should be met soon by new equipment developed by Pacific Seas Electronics Inc.

The new device called 'Auto-Sorter,' automatically tests diodes at rates up to 8,000 units per hour and immediately sorts them into as many as eight different types according to individual diode characteristics. To match Auto-Sorter's speed would require 25 human operators using conventional test equipment, according to PSI's Warren Lavo, operations manager.

Widepread Use

Although the semiconductor diode has found widespread use in avionics equipment because of its size and weight advantage over its vacuum tube counterpart, an inherent characteristic of semiconductors has put it at a disadvantage relative to tubes.

The manufacture of vacuum tube diodes can check control the performance characteristics of the end product by nullification and long-term tube life tests techniques. When a tube makes diodes to build a batch of ICs, he does not find any failures in the completed lot.

The semiconductor manufacturer has a more difficult job. He is able to measure only the gross rate of control on lead diode characteristics by using semiconductor material characteristics, "cut whisker" material, and the areas between the two.

For this reason the semiconductor manufacturer batches diodes into lots to see which lot has the best lot brought up. This may sometimes be done with similar properties.

The semiconductor manufacturer (PSI) runs up the variation limit test in an application engineering basement. Such a selection process yields certain types in certain quantities than others, and the policy has been to give the customer (type) in excess proportion to these characteristics. Likewise, the correct design should look carefully at the application and choose the type with the least rigid specifications that can be tolerated. In this way the lot only saves money but not by a more adequate supply of diodes."

Auto-Sorter Benefits

Auto-Sorter by itself cannot hope to remove the "black magic" that now exists in the semiconductor manufacturing art. Only finer and increased knowledge can do this. Now even Auto-Sorter checks change the total in a batch of semiconductor. Ideally, however, the tester should enable a technician

to obtain sufficient data quickly to make a statistical prediction of yield before all the diodes in the batch have been completed. This will in turn permit the manufacturer to alter criteria of his operations and such steps to change diode characteristics in the manufacture of the batch.

Equally important Auto-Sorter will permit effective management of materials, a problem which long has plagued semiconductor manufacturers (Harris 1968).

As an avionic equipment designer sends a diode with very special characteristics, the entire system can be quickly and economically assembled for such diodes. Proven such a match would have been far too costly and time consuming.

The new device also can be used to match diodes at one or more operating points.

How It Operates

To enable Auto-Sorter to search through an inventory of diodes for one or more characteristic types, it is programmed for the accuracy, tests and test limits. The diodes then are dumped into and automatically fed into a voltmeter system to make into test positions.

Up to nine different test voltages or currents can be applied to each diode in sequence to measure such things as reverse and forward current, saturation voltage. (Test voltages are checked against a built-in standard cell 60 times a second.)

The measured current or voltage is compared with limits set in previously by the operator, from which Auto-Sorter makes a "yes or no" decision as to whether the diode is within provided limits. When a test is complete, a diode might have to be able to meet the spec for several different tests.

However, certain types may be more strictly required than others. Auto-Sorter therefore compares the premises assigned to each type (input by human operator) then automatically drops the diode into a drawer corresponding to the best test priority type. Also types it needs.

Auto-Sorter can make up to 71,000 measurements and 123,000 decisions per hour.

In operational avionics, it within 82 microseconds for search up to 150 measurements within 1 microsecond; it can search up to 1,000 measurements. Harris says that Auto-Sorter is able to locate



Flying Control Tower

lightweight, light cable, two new support control tower can be suspended. It helicopters are lowered or steps and put into operation within 10 minutes. Helicopter manufactured by Greg Sinton, Inc., Boston, Mass., carries all electronic equipment

necessary to operate as support. Main, antennas and wind indicators are stored inside and being hoisted by Aero-1011 helicopter (right). Special lightweight aluminum and plastic construction provides strength and keeps total weight below 2,500 lb.



Filter Center

downcase with a reliability that far exceeds that of human operators.

PSI's new automatic tester is the result of nearly two year's effort, which included testing nearly three million diodes through the machine to check its sorting reliability. The machine is part of PSI's long range program to automate its semiconductor manufacturing operations.

It was developed under the supervision of Richard A. Campbell, assistant manager of PSI's engineering department.

Recent test and selection are major elements in the art of manufacturing semi-conductors. PSI expects that lower diode costs ultimately will result from the use of Auto-Sorter. However, the immediate gain comes in PSI's improved ability to handle companies for diodes with special characteristics and the assurance of accurate, reliable testing of all diodes.

Because of its potential value to digital computer manufacturers and other large quantity users of semiconductor devices, PSI has plans to sell Auto-Sorters to industry. The company's address is 19811 West Jackson Blvd., Culver City, Calif. The firm is a wholly-owned subsidiary of The Radio-Wholesale Corp.

▲ **Airlines Use Inertial Guidance**—New air controller to investigate self-contained navigation techniques and equip aircraft for possible application to jet engines has been funded by Airline Electronic Engineering Commission, Massachusetts Radio Inc. Preliminary meeting between potential equipment makers and airline people will be held on Aug. 22 in Washington.

▲ **Beauty & The Beast**—In terms, Westco which on the sea, Annapolis Veech Bery July 16 p. 58) showing parts, inside Vietnam operation who may be replaced by the WRV and its magnetic drum, prompts one reader to ask, "This is progress?"

▲ **Message Data Link**—Civil Aviation Administration will conduct new \$448,000 Message data link in avionics which will give data from a military radio network, approximately 400 miles long and 170 miles wide, into CA's Insensitive Air Route Traffic Control System. The system will be into an existing avionics network originating at the AF

base in Jacksonville, Ohio. At later date the system is expected to be expanded to obtain more data from Bellefleur, Colorado and Cincinnati area.

▲ **USAF Leases Radio Equipment**—Two new mobile communication equipment used at continental air bases will be leased by Air Force from General Electric under the largest contract of its type ever awarded, GEC says. Personnel each base was chosen to purchase mobile radio equipment is needed.

▲ **Reaching For A Billion**—Electronic industry in metropolitan Los Angeles area appears certain to get up more than a billion dollars in sales this year, based on last year's total before lifting of \$114,600,000. Survey, conducted by L. A. Chamber of Commerce Electronics Committee, shows 400 firms now operate in the area and employ 71,167 people. Copies of survey results are available from Chamber's Industrial Dept.

▲ **Tomorrow's Engineers**—To stimulate interest in research and development among high school students, Hughes Aircraft Co. recently will give lectures to secondary school students. Company also will employ a group of seven



NEW AUTO-SORTER makes it economically feasible to search through large inventory of diodes for units with special characteristics. Auto-Sorter tests up to 25 diodes in batch.



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Now... American Airlines famous DC-7 Flightrips are equipped with airborne radar. Located in the nose of the plane, it enables the crew to "see" the weather up to 150 miles ahead, and avoid any bad formations, such as thunder squalls. Radar means even smoother flying... a new measure of protection for American Airlines passengers.

For another kind of protection, American Airlines uses Sinclair Aircraft Oil to safeguard the powerful turbo-propeller engines of its giant DC-7's. In fact, for over 22 years, American Airlines has relied exclusively on Sinclair for dependable engine lubrication. Today, 47% of the aircraft oils used by major scheduled airlines in the U.S. is supplied by Sinclair - positive proof of the quality and dependability of Sinclair Oils.

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Sinclair Refining Company, Aviation Sales, 600 Fifth Avenue, New York 20, N. Y.



Epsco's New Airborne Data Conversion System...

Unique MINIDATAC is subminiature voltage-to-digital converter designed for flight test instrumentation and telemetering applications.

Russia, when Epsco, Incorporated, has announced that a complete conversion system will be developed and will soon be available in production quantities.

The Epsco MINIDATAC is a high speed, highly accurate voltage-to-digital converter, designed and packaged for airborne use under severe operating conditions. It is a sub-miniature version of the Epsco Model B-DATAC which has a proven field operating, without maintenance or adjustment, at better than 0.1% and a maximum speed of approximately 50,000 data bits per conversion per second. The MINIDATAC system is possible to convert voltage to digital form at the voltage source, thus ensuring maximum accuracy and reliability in subsequent transmission and processing of the data. Further, it is in a form suitable for direct or eventual connection to a digital computer. The convertible features of the standard Model B-DATAC converter can be utilized on the ground to convert the digital code back to its original analog form for further analog processing or recording.

Features

Proven Reliability — Standard packaged versions of this equipment have a proven life expectancy in excess of 1000 hours of reliable operation.

Long Term Stability — Stability for all conditions of component aging, power source variation, and mechanical shock and vibration will not affect the recorded value by more than one in the standard digit for the life of the equipment.

Simplicity of Operation — Except for a single factor adjustment, there are no operator adjustments or controls on this equipment.

Versatility of Data Handling Capabilities — The high conversion speed allows for many combinations of data storage rates. From 25.5 bits data input divided to hundreds of lower bit rates data inputs where electro-mechanical or electro-mechanical multiplexing is utilized. The MINIDATAC has new wide bandwidth capabilities. Epsco's FPM and FDM telemetering system combined.

A Technical Paper on this system will be presented at the National Telemetering Conference at the Hiltons Hotel in Los Angeles on August 20 and 21.

Serial and Parallel Outputs — Both a serial pulse train and a parallel pulse output are provided for simultaneous transmission over a radio or wire link and also use in a recording medium such as magnetic tape records.

Light, compact construction. The MINIDATAC contains eight solid state transistors which fit into the main assembly. The great economy in fabrication is achieved by using minimum weight. All access is from a common side which is sealed, thus allowing the unit to be processed for use at extremely high altitudes. All components appear on the side opposite to the access side.

Operating Characteristics

Conversion Time is a maximum of two micro-seconds per binary digit of data; approximately 50,000 independent data conversions can be made per second for a 10-phase binary code including sign. Each conversion from voltage-to-digital code is a one-way, independent of the previous conversion. Voltage data may be multi-phased and processed to the computer at any rate compatible with the slave conversion system.

Trigger or synchronization to pulse external signals at any repetition or random rate from 0 to 1000 per second up to the rates indicated above are available. Because of the independent nature of the equipment, it may be triggered or slaved from any arbitrary external source. It is also possible to control the rate at which each pulse is fed out. The rate is adjustable when recording or telemetering rate has been established.

Full scale voltage range maximum.

Standard Epsco Model B-DATAC Reversible Voltage-to-Digital Converter can be available for use during development and testing. It is a complete converter using data and power connections.

When the Epsco Mini, and standard Model B-DATAC converters have been designed to meet a specific customer need, and ability to approach the need.

range of 4.500 volts. Maximum is 0.1 volts. Auxiliary input equipment can be provided for handling signal levels down to 10^{-6} amp full scale.

Input Impedance for full-scale voltage of 1.000 volts — 100,000 Ω , for full-scale voltage of 100.0 volts — 1 megohm. For any other full-scale voltage, the input impedance available may be proportional to the square root of that voltage.

Output Provisions are made for the following outputs:

1. Serial pulse train (most significant digit first)
 - a. Output impedance, 500 ohms
 - b. Pulse Width, 1 microsecond
 - c. Pulse Amplitude, ≈ 10 volts
2. Parallel accessible binary voltage levels representing code
 1. Output impedance, 50,000 ohms
 2. Output levels
 - a. 6 volts representing binary 1
 - b. 12 volts representing binary 0, or vice versa

GENERAL CHARACTERISTICS
Size: 2 1/2" high x 7 1/2" wide x 3 1/2" deep
Weight: approx 7 lbs.
Temperature Range: -50°C to $+70^{\circ}\text{C}$

Shock and Vibration The equipment is designed to meet application-specific requirements.

Power Input 200 milli-approximately, 100-120 volts, 50-60 cycles per second, when used with associated power supply.

Accuracy $\pm 0.1\%$ or better specified and guaranteed.

Customer Adjustments—None adjustments are required, other than scale factor adjustment.

Additional technical data is available and your inquiry is invited.

EPSCO, INCORPORATED
518 Commonwealth Ave., Boston 12, Mass.

of 0.05 percent at 3 lb., operates over temperature range of -55 to $+85^{\circ}\text{C}$ with coefficient of max. 100 ppm/Deg. C. Units are available with requirements of 0.001 to 1 mfd. Condenser Products Co., Division of New Haven Clock & Watch Co., 140 Hamilton St. New Haven, Conn.

• **Subminiature Moser, Model 12-200**, for cooling avionics equipment, will fit into a 3 1/2 in. cube area. Unit operates



MOSER Model 12-200 Avionics Unit

from 115 c., 60 rpm, provides 10 cfm flow rate efficiency at speed of 5,400 rpm. McLean Engineering Laboratories, Princeton, N. J.

• **Instant overload protector** for motor motors, designed to prevent damage such as heat burnout and coil burnout, can be installed on new or existing instruments without affecting calibration or



accuracy, according to manufacturer. Device protects by overheat or gross ± 100 fpm rated sector exhaust and reportedly improves factor sleeping characteristics. Electro-Systems Co., 5123 San Francisco Blvd., Los Angeles 29, Calif.

• **Subramanian choker**, designed to MIL spec, are available in various ratings from 1 1/2 to 120 mm diameter. Series sets up to 15 mil. sec. pneumatic flow, while large sizes are provided with forms. National Co., 61 Sherman St., Malden 24, Mass.

• **Transfer jet** for gas jetted circuit use, called "Virex", is available with maximum of 0.175 in. factor flow 0.175, at pressure of 100 to 40,000 lb. Use is noted at one watt at 40C.

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Write for Clincher bulletins 555; Riveter bulletins 646 and 555. The Tomkins-Johnson Co., Jackson, Mich.



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FORMERLY THE TOMKINS COMPANY, JACKSON, MICHIGAN

29 Years Experience



but can be operated up to 1200. Stand-off resistance tolerance is 5% and non-positive coefficient is 0.0025 psi dc. Price: C. H. Housh Electronics Inc., 4755 Kenick St., Van Nuys, Calif.

• Traveling wave tube, Type 6051/BA56, for S-band use delivers peak power output of 1.5 kw using accelerating



voltage of 5000. Tube weighs 7 lb., measures 17 x 12 in. Atomic Laboratories, Inc., Silver Road, Beverly, Mass.

• Silicon rubber diodes, four new semi-conducting pastes for I, S, C, and X-band tubes, reportedly provide up to 2 db more reduction when substituted for IN40C and IN41C diodes. Used as an additive with lead formed on selenite pedestal. Microwave Associates, 22 Crenshaw St., Boston 15, Mass.

Instrumentation

• Airborne 4th amplifier, Model 211N-2, with isolated input circuit can be used with airborne fluoroscopes or video tape bridge measurements. Amplifier's 1/2 in. case size and full response to 100 cps permits it to handle as many as 250 points per second where conventional is used. Application data is available. Ducommun Div. of Honeywell Inc., Houston, 1460 Soldiers Field Road, Boston 35, Mass.

• High-speed digital records, Model 7171, provides simple and economical means for simultaneous recording on 71/2" tape phenomena on as many as 15 channels at sampling rates as high as 2,500 per second. Records are made on Videotape electro-optical chart paper at recording speed of more than



150 in./sec., providing approximately 1 in. spacing for the 25 kc sampling rate. Chart paper drive mechanism is automatically triggered to advance chart paper to recording sequence. Better Instrument Co., Inc., 115 Crater Mill Road, Great Neck, N. Y.

• Piezoelectric pressure transducer, Model LC-13, amplifies raw inorganic sensitive element capsule of measuring five fold pressure versus time for sound or shock waves. Unit covers dynamic



range up to 1,000 psi and sensitivity is 0.1 mV/in. 2 db. Data 1 to 50,000 cps. Transducer sensitivity is stable over temperature range of -40C to 100C. Allied Research Corp., 941 No. Columbia St., Alexandria, Va.

Microwave Devices

• Traveling wave tube amplifier for X and L-band with broadband noise figure of 10.12 db. Type BA-17 covers frequency range of 8.17 to 14.5 GHz. Bandwidth 25.38 db gain and 5.10 ms. output. Hagans Laboratories Inc., 711 Laurel Ave., Menlo Park, Calif.

• Striped line, Model 230, designed for parabolic, can measure VSWR over frequency range of 100 to 4,000 mc. Device consists of a section of coaxial transmission line of parallel plate type, a 100-ohm probe and a radio frequency detector. Characteristic impedance is 50 ohms for Model 210, 40 ohms for Model 230B. Device is 1 1/2 in. dia. and cost \$ 9.85. Milsco Corp., Alameda.

MALLORY-SHARON reports on

TITANIUM



World's fastest flies with MALLORY-SHARON titanium

• Performance details on the U.S. Air Force's new Lockheed F-104 are classified. But one thing can be said: all metals—including titanium supplied by Mallory-Sharon—used in this advanced aircraft have met the most stringent requirements.

Mallory-Sharon, one of the leading producers of titanium and titanium alloy mill products, has paced many improvements in the metal which account for its rapid

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B-66S IN FORMATION: Flight by dual number Swainey was made in production model RB 66B at Douglas Tucson facility.

Flight Tests Compare Douglas B-66, A3D

By Richard Swainey

Tucson, Ariz.—B-66 and A3D are, (below) almost airplanes—they evolve from the same basic design and both are manufactured by Douglas Aircraft Co., Inc. The A3D is a high altitude, Navy bomber, the B-66 a high and low altitude USAF bomber and reconnaissance plane.

- B-66 started as a Korean war effort by USAF to get a tactical all-weather bomber, represents an "all the shell" box of an A3D with its modifications only. Flight in both worlds, as well as studies highlights the differences and similarities.
- An delivered to its users in the Tactical Air Command airplane, the B-66 is an all-weather aircraft.
- Its excellent low as well as high altitude capabilities.
- Can save almost weight.
- Has a top quality low altitude landing system in the K-3 stabilizer.
- Has been through, even its inception, a road program for Korea — developed development well war's end, then in accordance with the Clark-Clegg Plan.
- When delivered to TAC in both the B-66 and RB-66 versions included all the latest engineering refinements and modifications, practically meaning a rebuilt one end. The RB-66 test cycle has been halted.

Highly Maneuverable

During a flight in a production model RB-66B at the Douglas facilities, there was opportunity to check both high and low altitude flight characteristics of the versatile bomber. Principal operations guided by the engineering personnel of the design organization.

Plot on the flight, presently a check-out of the ILS approach complex of the

Merazopols-Bentzenfeld airport, was taken from the aircraft flight operations manager at Douglas' Tucson facility. Chief was Robert Almond. Abstracts on the Tucson RB-66 and various flight ranges from above 40,000 ft to deck level, speeds from maximum to just above stall of low altitudes, maximum at high altitudes.

In the approach configuration, speed brake, flaps and gear extended, the plane did a highly maneuverable, both at high and low altitudes. While the most severely reported landing edge data, control through the stall buffet and recovery good, and almost certain other refinements.

Opening bomb bay doors at high speed with results of no wing or airfoil changes out of the ordinary, and buffet has been almost and after both have been encountered in the flight test program.

Single point high pressure refueling is accomplished. Fuel flow from wing to fuselage tanks, with engine stopped, low rate loading tank. Fuel management is accomplished from a control panel on the pilot's right and is automatic with CD instructions. However, the pilot must beware of accumulating the wing tanks into the active system once they have been past panel.

When USAF directed an A3D program, a proposed first flight was set for 7½ months from date of contract, predicated on changes being held to:

- Definition of service operation program.
- Addition of crew equipment.
- Specific tests to be modified.
- Large scale analysis to be provided.

Between Feb. 15, 1957, when the decision to buy was made and the engineering release of the design in April, 1951, 112 engineering change proposals had been incorporated. The aircraft,

an RB-66A made its first flight in June, 1954.

The first B model, a B-66B (the last for RBs ordered) for A modification, the remainder were made B's and the first of the B-66s incorporated the changes, making them B-66Bs) made its first flight in December, 1954, after an engineering release in Aug., 1953.

Engineering Changes

The airplane spanned four years from start of contract to delivery to wing TAC squadrons at Hurler AFB, Fla., and Shaw AFB, S. C. Total changes from the original A3D receipt, all incorporated in the delivery airplane, exceeded 400.

During its development, some of the

Skywarrior Next

Next work Navy's Douglas A3D-1B version will be incrementally added by Associate Editor Irving Stone of Aviation Week's West Coast Bureau. Stone, who made an extensive inspection tour through Douglas' El Segundo Division, where the A3D is being produced, will discuss how Swainey is selected to the program and will suggest to meet the language attack bomber market.

Richard Swainey flew in both B-66B and A3D while gathering material for the story in this issue. He has flown nearly everything from small single-engine personal planes to jet aircraft, has once entered some 3,000 hours of flight time, and was a test pilot in the flight test version of Wright Field.

Whom Swainey's story in this issue corroborates on flight characteristics of the B-66, ASD, Stone's will have to do with the structural components of the airplane, and illustrated with pictures and extensive drawings.

- major changes, problem areas and fixes on the B-66 included.
- Control system, altimeter and speedometer changed.
- Wing angle of incidence changed from A3D's 4 deg. to 3 deg.
- Engines were changed from the J71-A-9 to the J71-A-13, to the 13,500 lb thrust class.
- Brakes were changed.
- Slats were changed to permit in-flight.
- Engine mounting pylon was changed.
- Flatter problems were corrected both by floor buffet control changes.

Buddy System

The airplane is currently programmed for buddy system aerial refueling. In addition, new A3D-1B buffer of approximately the same thrust as those currently used, but with other characteristics changed (including different pitch) are being tested for maximum gross weight and overload tolerance from existing models.

As of Feb. 7, 1956, with the first RB-66A still part of USAF's test program, more than 570 test hrs. had been flown on the design in more than 400 flights. Of the several orders, 19 were put into the Douglas and USAF test program.

Trainee-Version Considered

The B-66B, RB-66B and RB-66C are in taking standoffs. It is understood that a bomber version with dual controls has been considered, as well as final floorplans for observer positions. The plane normally carries a crew of three-pilot and two observers in both low altitude, reconnaissance and ECM missions.

In an A3D flight similar to that of the B-66 type, the difference between the airplanes was apparent. Pilot for the airplane flight was Col. Charles W. Hurler of the Navy. Backer, officer at Douglas' El Segundo Division. In one observer seat, the A3D also carried a second crew of three, pilot and two observers, was Lt. Col. G. T. McHenry, also of the El Segundo Base officer.

In appearance, the differences are both wing trailing edges, with the A3D retaining the original straight trailing edge. Wing sweepback, 16 deg., is the same for both planes, but B-66 has extended center section trailing edge.

Mission Differences

The A3D-1B uses the J71 P-6 engine, made by Pratt & Whitney, while the B-66 is made by Allison. Also the A3D-1B, later production model of the Skywarrior, uses the J57-P-40 A3 engine but in the 13,000 lb thrust class, go 66 ft, without afterburner and has variable pit static exhausts. These differences between the planes



NAVY VERSION, A3D, similar to its landing on USS Forrestal. Wing sweepback of 16 deg. is same for both A3D B-66 but B-66 has extended center section leading edge.



A3D ON DECK of Forrestal. Finlay difference in two planes is in mission. Navy's is high altitude USAF's has low altitude. A3D's nose J71-P-6 engine. B-66 nose J71-P-6.



ROBERT ALMOND, flight test observer, Douglas Aircraft Co., Tucson Facility, Robert Almond manages flight operations, Robert Swainey, Aviation Week, reports editor.



Double of crystal clock sources, the F-101A is scheduled for assignment to the Strategic Air Command. The new electric system and computing sight help make it one of the most advanced fighters to date today.

GENERAL  ELECTRIC

How G-E Electric System and Gunsight Help



Key components of system include built voltage regulator and control panel.



Automatic analysis test. General Electric tested the complete F-101A electric system prior to final airplane installation.



Typical computing sight operates pilot's view central and wings target in sight.



Pilot keeps enemy aircraft aligned in sight and slow when target is within range.



Hit. Enemy gone since that enemy would have been destroyed.

Make F-101A a Potent SAC Fighter-bomber

- G-E power generating system eliminates 10 pilot functions in start-up
- G-E computing sight permits more accurate weapons firing

The Air Force's new supersonic jet fighter, the McDonnell F-101A Voodoo, is being equipped with a G-E computing sight and an automatic electric system which requires no pilot attention.

Designed with emphasis on simplifying the job of the pilot through use of automatic equipment, which includes a paralleling control furnished by another manufacturer, the G-E electric system begins operating as soon as the pilot starts the engine.

SPRINTS TAKE-OFF The control has only two toggle switches, which may remain "on" at all times, even when a fault develops. This eliminates a series of 10 pilot functions, and sharply reduces the time to become airborne.

With a generator that can operate at the high sea-air temperatures of supersonic flight, and a static voltage regulator that has no moving parts except the relays, the G-E system is designed for

long life and reduced maintenance time. The control panel supplies the automatic control of start-up, shutdown, and maintenance; electroprotection against ground fault, over- and under-voltage, and over- and under-voltage.

LIGHTWEIGHT GUNSIGHT HAS HIGH ACCURACY Giving the F-101A high fire-control accuracy for air-to-air gunnery is the G-E designed computing sight. It features lightweight and low maintenance due to its simple design. Automatic inputs assure the sight's accuracy for all modes of operation.

For more information on the General Electric power generating system, write Section 210-97, General Electric Co., Schenectady 5, N. Y. If you are cleared to receive classified material, see your nearest G-E Apparatus Sales representative for advantages of the computing gunsight. General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



RB-66A MADE its first flight in June 1954. Tail changes from original A1D concept exceeded 600 including new control system, altimeter, speakers and egress.



ENGINE ADJUSTING job on RB-66A was changed to classic configuration, straight leading edge, elimination of leading on top of wing. Note A1D posture page 64.

is in excess, the Navy having a high altitude aircraft, the Air Force a low-altitude design.

A1D Performance

In the A1D, tail flying resulted in modifications which were extended to the B-66 where applicable. Standard, B-66 tests indicating improvements which could be incorporated on the A1D, resulted in changes to the A1D. Since the A1D preceded the B-66 in service, the impact of change sug-

gestions with the Navy plan.

In flight, the A1D performs excellent in indications of the suitability of the basic aerodynamic configurations on which both planes are based. While the A1D retained fuel of about 40,000 lb., B-66 fuel range starts a little lower.

Both planes possess stable and uniform load characteristics in the high speed buffet zone. In trials, the A1D also stays comfortable and gives ample

buffet warning before complete stall. The gross characteristics at high and low altitudes is excellent. In the fair configuration, the A1D also has some good flight characteristics although its essential capacity on flights higher or low level are up products.

Escape System

A1D has a fixed escape system with the crew going out the bottom of the airplane, facing to the rear, a concept Douglas studied for previous airplanes in its F3D Stealthlight fighter. Downward escape can also be accomplished in the ejection seat equipped B-66, although the passage is smaller and more difficult to get through.

Like the B-66, the A1D incorporates tail defensive guns and warning radar as well as egress capability.

A1D has a smaller JATO assist system than the B-66, since its more mass effort take off from a narrow deck of the modified Enewe class (about 300 ft.) at 70,000 lb. gross weight. The plane also runs apart from the F-4's in Boeing's class of carrier, as well as from the forward speed carrier.

A1D is produced at Douglas El Segundo Division, the B-66 at Long Beach.

Non-Citizen Engineers Used in Unclassified Work

Non-citizen engineers are being used by General Electric Co. on precision aircraft powerplant design. GE's Aircraft Gas Turbine Div., Cincinnati Ohio, has organized a special section staffed with engineers from European and Air-Force sources. Until they are cleared for classified work, GE is limiting those efforts to power plants with low speed and altitude ratings.

Among the group are Dr. Gerhardt

Dudach, Germany, (also designed the gas jet for the V-1 buzz bomb); Jürgen Henne, Denmark; Werner Oldhans, Germany; Jan Gustaf, Sweden; Jan G. de Groot, Belgium; George and Dr. Tjallie Meesters, Peru.

"We are offering contracts to a limited few in the confidence that they apply for citizenship," W. R. Dodge, GE spokesman explained.

New R&D Corporation Organized in Florida

An addition to the guided missile research and development field in the new retirement town Research City, Fla. has located in Cocoa Beach, Fla. The new center at the Air Force Joint Long Range Guided Missile Test Range.

The primary objective of the new corporation is close coordination of research and development by private industry with the requirements of the Department of Defense.

The new company is particularly concerned with guided missile nose sections.

Companies with even limited research capabilities will be coordinated in the big R & D project which formerly could be handled only by large corporations with a diversity of research capabilities. By offering the engineering talent of the smaller companies, close coordination is expected to help solve the control shortage of scientists and engineers and expedite the national R & D program.

It was staffed by a group of research consultants who have been active in the field of rocket motors. By great measure in such fields as propulsion of solid motors, radar and laserjet guidance and control systems, electronic and optical equipment and systems for the collection of data, problems solving of complex mechanisms and instrumentation theory studies.

Lockheed Transfers Nuclear Aircraft Work

Lockheed Aircraft has completed the transfer of all design powered aircraft programs design work to its Georgia Division.

The 150 engineers involved in the transfer are the core of the staff which will operate the nuclear aircraft research laboratories to be built in Evans, Georgia, for the USMC. Announcement that Lockheed will operate the facility was made in April.

Vito Engineering Corporation of New York will design and construct all buildings, warehouses and access roads on the 40,000 acre site. Types and total number of buildings have

NEW!

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1.675" dia.
precision
miniature
a.c. motor

EXTRA HIGH SYNC POWER!

Globe, the precision miniature motor manufacturer, now enters the field of higher yet constant and lightning accurate motor revolutions per minute and speeds. The new motor measures 1.675" dia. x 2 1/2" long, and weighs only 11.8 gm. Incorporating Globe's latest advancements in synchronous-motor design, they provide absolute synchronous rotation, extremely low inrush currents, and high starting and running torques of 1.2 oz. in. In the 3000, 3600 and 3800 rpm, sets are available with integral planetary gear heads in a broad selection of gear speed reduction ratios and torques up to 200 oz. in. In addition, sets with up to 2.8 oz. in. starting and running torque, and suitable frequency sets are also available in this new power size. Sets are designed to meet military specifications. Write today for Bulletin 1120.

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Delivered to the best by product and its service... precision, accuracy and a.c. motors and motorized drives.



NEW JATO BOTTLES are being tested on the RB-66 at Edwards AFB. Steps toward tail behind JATO installation on transition sensitive front components, ends with a different seating gear. When tests on tail temperatures at various locations are determined by the actual pilot, New JATO bottles were required because of the old configuration, were showing the loading when dropped. Bottles mounted there are made by Phillips Petroleum Products. Other units used on four Ansony General and A1G when Robinson Laboratories



Skywarrior Slows Down

A fuselage pod is being fitted to all YD-10 Skywarriors being produced at Douglas Aircraft Co. in Long Beach, Calif. The pod will be used for landing on soft fields and will also be used to improve deck landings of the carrier-based fighter. It will raise side loadings on wet runways during instrument landing mode under GCA conditions, as in instrument landing mode with high gross weight. Installation is designed for normal touchdowns at 130 knots and emergency speed of 170 knots.

control engineering. Dr. John B. Fera, director of the Navy Speed project Design Group, conducts an aerodynamic and combustion. Dr. Sun-Chong, gas dynamics. Dr. Irvin Grossman, expert on jet mixing and noise propagation. Dr. Irvin Gray, combustion and aerodynamic specialist, and J. Preston Larkin, chief jet propulsion research engineer at Terminal and first president of the new firm.

Supersonic Human Factors Studied at Northrop Aircraft

Human factors engineering studies are being conducted at Northrop Aircraft Inc., Hawthorne, Calif., to determine pilot visibility, to cope with extreme operational demands of supersonic aircraft.

Working on these advanced studies are Northrop's Dr. Gerald F. Babcock,

psychologist and Dr. J. Gordon Wells, psychologist. Target will be to determine the practical points at which high speed flight at which man's mental and physical abilities must be selected to decrease computer and semi-mechanical status.

Testing will be led by Northrop designers targeted to high speed aircraft projects, including development of the company's new supersonic jet trainer. The study program is being directed by Fred L. Eckman, head of Northrop's Human Factors Engineering and Equipment Design Section.

Invention of Centrifugal Pump for USAF Reported

An Israel Institute of Technology professor reports that he has developed a pump which works by contracting

rather than centrifugal effect. Mezer Benzer, head of the Institute's Micrological (Institute) Laboratory, says that because the centrifugal action increases with decreased air density, his pump will have a "vortexless effect" on high altitude flight.

The pump has been sponsored by a U.S. Air Force contract.

French to Use Republic Ejection Seat in Mystere IV

French Republic Mystere IV jet fighter will use Republic-designed ejection seat which concept is installed on F-4E Thunderbolt photo recon fighter and the supersonic F-105 fighter-bomber. Seat is first American design concept to be used in a European jet fighter.

Republic has licensed the Soviet N. I. Zhukovskiy Aviation Institute's seat (SI-ZNCA-51) to construction firm, now systems are fitted for use in the Mystere IV. SI-ZNCA-51 also is being used for other projects contract by Republic. At present, Republic is in European industry. SI-ZNCA-51 is service with NATO.

THRUST & DRAG

Fight in Hollow Dept.—This came from a Warsaw Free press plugging a variety of films with aviation background.

The high-speed here in the Drag Index—the film actor—says there is his part so completely that he too gets the drag log.

Wilhelm Heister, long known for his daring acts, was an original cast member in "Towards the Unknown" that he could his way ahead an advanced



Power for the World's Airlines



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GAS TURBINES,

have been ordered

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*Rolls-Royce gas turbines have already flown 1,000,000 hours
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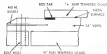
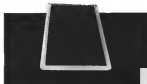


Spaniards Demonstrate Jet Trainer

A European demonstration team is being made by the Hispano HA 200R1 two place jet trainer designed and built by the Spanish company with assistance of Wally Minor school. The flight is two 100-ft. dual. The team led by some sailors and engineering out of specific help from the leading edge of each wing. Tests by teams of men have shown it to be superior in response to different Vespene types, and may kill out of 24 000 lbs and use DME111 offered to serve by Sweden.



Good visibility for Boeing B-52 pilots with electrically heated "NESA"™ windshields



Just about everybody has worn pattern and head of the 400,000-pound Boeing B-52 long-range heavy bomber.

At extreme altitudes, it will fly more than 6,000 miles without refueling—and on trips like this, the pilot must be prepared for any kind of weather. As far as visibility is concerned, he is prepared with a NESA™ Flexand™ electrically heated windshield. The 10" semi-tempered outer glass ply has the NESA coating on the inside surface to protect against icing and fogging.

Pittsburgh Plate has developed many special

A report from THE PITTSBURGH AIRCRAFT GLAZING FILE

aircraft glasses, and our Technical Representatives will be glad to discuss them with you and help solve any of your difficult aircraft glazing problems.

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De-Icing Research

A portion of Boston's Beverly Air Temple wing proved these five designs of a Lavolta de-icing system. The six rows of electrically heated shield of the test wing section were tested twice to create the icing atmosphere. Washers are fitted below the test wing to allow photographic observation. Naper's Flight Development Establishment says that the testing will be done at 12,000 ft. altitude at temperatures from -9C to -36C. A flight speed of 150 knots IAS with the wing section at an effective incidence of 3.7 degrees will simulate freely ice and 115 knots and 30.5 degrees will represent shield.

lights-transmitter jet at Edwards Air Force Base in California and became the first plane to land the same way.

And now comes Klaus Moose in "Safelike as the Sky." Moose plans the captain of a cockpit ship making man's first trip into outer space.

"I have not purchased a Bachmann set," Moose said, "but the Frig Bag has helped me. It was these places—the Arvo Defts and the Polard Midge."

He continued:

"Sitting on them, not knowing what the shaft and pulleys are for. Working them by Frig in these. Brother! As soon as the partner was finished, I signed up with a flying school and I'll be sitting soon."

Is a Polard Midge, Mr. Moose?

The complexities of contractual relations between customers and the Air Force sometimes delay decisions. Of course, they drive some of the parties to discontinue, producing losses of longer or shorter lengths.

In the latter category is this anonymous document which purports to be a management proposal submitted to the Air Force as part of the routine established for getting a contract. It may be true, for you to identify the company, no names have been deleted. You can draw your line.

Management Proposal

1. General Experience

A detailed advance to the large number of programs which we have managed would be beyond the scope of this proposal.

has report 7912, AF Board of Inquiry, is the signal of Congressional Oversight Committee, 1209 A. We felt how odd, that the experience gained from these multiple failures just as a strong representative position more in a matter that these matters will be repeated. The conclusion may have a greater number of failures, but we would like to point out that our various cases make our legal and most important projects. Furthermore, we have steadily an experience in the operations, but we support for this design and will therefore approach the problem each and every time.

2. Operations

We have reviewed this question carefully and find that we are unable to alter with the precise nature of this, which the contract division to see the contract issued and we therefore at a loss in the way to present it. We have undertaken the use of high speed, constant and dynamic, workable at times for providing a change organization, but not the best, do not meet the requirements. We therefore request that the customer specify the material design. We suggest a time during the interval from 1200 to 1230 on a Sunday would be best in experience, but flows that the use of change it at a moment during the period.

We have listed on recent proposals that we have received of other laws on, at our completion a few days after the submission of a lot of proposals. Since these times to be broken of a score but in the customer's organization, we request that a word to know be established before this information is applied.

3. Technical Approach

Our plan for this project is to hire experienced from the companies a high level of cooperation. Our technical approach will

Engineers



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"Want engineers" and other steeply skyrocketing demands are just part of the vocational engineering and drafting market picture in All America. You find too a wide range of other projects including the famous Hydro-Lift bridge over New York's creek and no one knows design in Right engineering and relating systems and finally change of culture — stimulating and challenging programs for Area and Mechanical Engineers.

What's in it for you? A really outstanding opportunity to develop with a young, dynamic organization, efforts to help you get your own piece to work, and also to provide a flexible growth plan your career growth.

Once a Real today, no confidence, of course, to Ray Henry, Chief Engineer.



All-American
Engineering
Company

MEMBER ASSOCIATION OF ENGINEERS

because it decreases it, these people and me be obtained less of competition possible. We do not do it for (making pilot light). We have been told on a project of the future about 12 to 15 months we're going to crack the nut with the jet. The time is spent in winning other contracts, everybody had last idea and so nothing checked reports and Aviation Week. The award is followed by a 6 month study phase. At the end of the time, it is usually desirable to start looking again to one of the extremely rapid changes that take place in the State-of-the-Art.

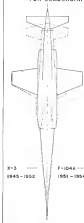
4. Schedule
In order to require the appearance of our project the jet department has two up

7. **Aviation schedule** says something plus plus aviation. The story is on the other hand, represent a straight ahead between the geometry of the Research and Sales division (they are the Sales Division) (in any event, company projects, it is to initiate a project when the program is studied on a fair and more profitable contract.

5. Subcontract
It is a firm company, policy is never let a dollar get out of the house.

6. Cost Information
Engineering does not plan to spend much less. We have found that engineering costs change and the volume profits. Factors—this is a large story. We were

LOOK TO DOUGLAS FOR LEADERSHIP



X-3 1945-1952 F-104A 1951-1954

the contract is an excellent opportunity to build on our plant.
Viewing—change has been put to use we do not plan to let it go. The past two programs have shown up better and more confidence of contract work (before the contract was M) have been discussed in the field.
Subcontract—this item has made much contact less, the request for proposal, we have added it.

T. Contract Plans and Policy

An extensive study will be made during the first 6 months of the contract to consider three factors. All of the modern techniques of operational analysis, game theory, and high speed computing will be applied to the problem of profit optimization.

Key points in the study will be top management, design and research section changes. It is expected that special materials Liaison committees will be started for this work due to the increasing importance of the problem.

S. Physical Resources

An excellent survey of our physical facilities is contained in the Research & De-

part prepared during our most recent long-range planning. A copy of that report is available.

F. Additional Facilities Required

It is our belief that an important project such as this should not be carried out in an existing plant. We plan to use space near our existing facilities. However, we would like to present our own special ideas of the program here. Facilities generally which they would be willing to add to the government for the control of this facility.

PRODUCTION BRIEFING

Warehouse for Mustang aircraft used, has been opened by Transair Metals Corporation of Austin, Tex. Address: 6485 Canotte St., Los Angeles, Calif.

Spot welding machine, most powerful ever produced, has been developed by the Furniture Div., Wisconsin Co., Inc., Buffalo, N. Y. Feed of 30 smaller machines in a 50-million Air Force



contract, the Furniture machine is said to be able to sever 150 lbs. of aluminum per minute with 900 in. accuracy from parts up to 3 ft. wide and 60 ft. long.

Dair's Machine Specialties, Inc., Chicago, machine production Pratt and Whitney Co. jet engine production by widely striking rates into shared. This direct assembly method has



stopped or completed closed position from five to 50 times per day. Method eliminates tolerance variation as each case now becomes its own part and gauge. Pratt & Whitney developed the original design concept.

Hamilton Standard Division of United Aircraft reports that three years of operating metal-plated propellers on C-119, P-108 and T-17 has convinced them that the metal plate definitely increases the propeller's ability to withstand runway rocks and salt spray.

Wilson Steel & Co., Inc., Wichita, Kans., announces a 13,000 sq

ft. 5300-600 addition to their Ninth Warehouse Plant. Part of this expansion is due to the increased demand for the company's high temperature turbine and turbine sub-assembly work.

Predictions from the National Security Machine Products Assn. (NSMPPA), annual sales of some machine products will rise from present \$485 million to \$700 million in 1965, current death rate of small companies will result in few or bigger firms, and more complete automation will take place. The NSMPPA says that while a rate could set knock-up in business for \$7,000



DESIGNER: VIKING
The Aer's new 17, but doubling over the windshield of my plane is a day when you were in a hole. It seemed as if the door of a airplane little bit—just to make my eyes after taking up on his. It's days through the tunnel. We've grown up but, those girls, all year.

experience has been in the right places, and your technical skills are not and vice. Now prefer 20000 with ball, sharply fine, especially also designed by an international, known-way process after a 10, 200, and 100,00.

Southwest Airlines—no Florida service at Orlando 30 years old but, airlines you, in the NYNY stopped meeting, New, and has:

1. Opened a Mid-West Division in Kansas City, Mo., in 1952 and since the problem of the Dallas Pioneer, Red Bank, Pioneer Central, Union and Pacific divisions of the Western Airlines Corp., and of the All State Flight Division of 19, the American South, and K. Thompson Co.,

2. Opened a Rocky Mountain Division at Denver, Colo., as distributor for the Nevada Products and Nevada Pacific divisions, All, distribution, and services, and

3. Moved ahead with plans for the new \$2,000,000 service and parts distribution facility at Love Field, Dallas.

THOMAS DILLON in the Future
is illustrated by these developments to the past and present. They always take from the rear with Southwest Airlines. Those to Alaska or 11, 1000 miles in time to the rear of me and up from Hawaii. I've always the 2000 of such of mine and 100—nobody will please!



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Daddy

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ROYAL GULL IN NEW DAILY AIR-TAXI SERVICE TO LAKE TAHOE

Around the bay from San Francisco to Sausalito, Commodore Air Service makes the home base. Every day 14 day 60 minutes after pilot Bob Lee take off on his scheduled daily round trip, he lands his beautifully appointed Royal Gull on beautiful Lake Tahoe, 6000 ft. above sea level. An hour later, ground crew opens a 1000 ft. hole's waiting by way home. The fine passenger Gull is ideally suited for such water-to-water commuter service. Its amphibious design with 170" landing flaps, however, adds a great measure of versatility, convenience and safety for land or water land operations.

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5 HEADS for the Reconnaissance Pilot?



How do you line up on target, fly the aircraft over the target, position the sensors correctly, search the light instruments and monitor the camera outputs—automatically?

Chicago Aerial's answer: *in-line control area* on another flight instrument. The Perspective Viewfinder permits the pilot to see through the airplane and make ready the ground area below and ahead—the view must first be photorecognized. With its sensitive wide angle and narrow angle views, the Viewfinder guides the light, directs the key tracks through aerials, cameras, and sends all the light to the pilot's eyes. With CAI's Viewfinder the brilliant, deviceless image preserves the actual color and fine detail of the ground below.

Long or short eye relief... magnification in wide-angle—these and other parameters are tailored to particular search requirements. From mounts through interconnects, the Viewfinder is a substantially CAI—only one of a long list of standardizations.

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Chicago Office: 300 South Michigan Avenue, Chicago 4, Illinois

during World War II, today it takes \$125,000 and the factory has fewer. A 51 industrial company sets only \$70,000 after taxes. The NSMFA, which says that they represent more than 200 producers whose output now prices more than 65% of the national total, is located in Cleveland, Ohio.

Lockheed Aircraft Corp. is adding a \$3,000,000 to its 44,000 sq ft. B-52 field sub-assembly plant, Balaclava, Calif., to handle subassembly on their turbo-prop Turbo-Electra engine.

An industry panel on use of steel composites in aircraft has recommended that the government spend up to \$1,250,000 annually "for several years" to coordinate industry attempts to produce reliable steel pressure containers with ultimate strengths of 150,000-200,000 psi. Their report, PB 123148 Pressure Steel Castings for Aircraft Use, can be ordered through DTIC, 8 Dept. of Commerce, Washington 25, D. C. for \$1.75.

Nassau Method Co.'s "Multi-view" machine continuously duplicates several, identical, views. Individual strips are long fed in from the left and oriented and loaded into a helix, which is the device to the right. The Costa Mesa, Calif., firm says its ma-



chine can automatically produce a 36 in. wide row-pair of aluminum skin, less steel reinforced structure, normally 1/8 in. or more at the rate of one ft. per sec. Present pilot production facilities are being augmented by two production machines.

The Automatic Control Device Class Corp., San Gabriel, Calif., made \$1.3 million worth of deliveries in the first six months of the year. The division is producing control and guidance mechanisms for North American, Convair, Focke, Anson, Acoust, General Wright Aircraft and Cal Tech's Jet Propulsion Laboratory.

Thermo Materials, Inc., New York, Cal., has been expanded to manufacture and distribute high temperature

resins. Contact and ferrite stores Company research will aim at producing high temperature components for rockets, guided missiles, jet engine nacelle engines, and electronic components. Tom D. Perry has left Stanford Research Institute to become general manager.

Southeast Research Institute, San Antonio, Texas, has two building projects underway which are helping to expand San Antonio's "Science City" area.

Chas. E. Pratt & Whitner's 5000-093 catheter effects steel tube which will contain two sets capable of handling up to 10,000 cases of relief of and the other is Acute Catheter's three-quarter catheter device research laboratory.

The Kerkorian Div., Rio Hato Manufacturing, Inc., Bridgeport, Conn., has developed a corner cutting tool which is loaded in a steel bar. The product,



called Kercut, is said to outlast other tools 25 to one. National distributors of Kercut tools will be located by I. C. Chappel & Co., Fairfield, Conn.

Walnut Corp., Madison Heights, Detroit, Michigan, has been awarded a contract to manufacture connector cradles for metal cutting blades.

Aluminum Co. of America's Lathette, Ind., says it will build a train in the world's largest aluminum plant. Also will produce frames for 30 rail cars, 140,000 lbs. gross which will be in use to produce structural shapes such as wing spars and ribs. Made up to 118 ft. long and 2,100 lbs. weight. Aluminum says that the extension of the Lathette along with its train, owned by the Air Force but also located in the Lathette works, will encourage designers to design for the weight advantages provided by large one piece extrusions.

General Electric's modularity computer is being used to determine proper speeds and feeds in the Chicago Plant of Seely-James & Co. GE Corbode Dept. computer is a portable device into which the machining variables are dialed and out of which is read the best manner of handling the machining job so that more economy results in the reduction of individual toolcuts.

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Expressing Ahead for a Better Tomorrow

NORTH AMERICAN AVIATION, INC.
COLUMBUS DIVISION



RADIOGRAPHIC SERVICE being performed (left) at Mitchell Air Base in a GE 179 is now suspended for welding leading edge of port by Raytheon X-ray and Metal Treating Laboratories Inc., of a wing. Radiographic position for inside wing. James W. King, New Canaan, L. I., in Connecticut, brought to equip machine; equipment (right) is typical set-up for X-raying wing spar.

Portable X-Ray Boon to Aircraft Industry

By George L. Christian

New York—Portable X-ray equipment for non-destructive inspection of aircraft and their components is paving its way to the forefront of aircraft inspection in the airline industry. Airline carriers, however, are turning to portable X-ray machines for simplified ways such as inspection of complex turbine air ducts, bolt and inspection of galled insulator lead tracks, and other close-up structures.

(This article is not connected with large, industrial-type X-ray machines which have long been used in aircraft and other industries for such jobs as inspecting forgings, castings and weld joints in a factory or semi-productive basis.)

At least two U.S. and five foreign airlines as well as several airline companies on both sides of the Atlantic, are using portable X-ray equipment for non-destructive inspection. One airline said that in the last month it X-rayed 10,000 rivets, 100,000 bolts and two engines found to be cracked.

Airline carrier told Aviation Week X-ray inspection was instrumental in having the Civil Aeronautics Administration increase the repair interval period of its fleet of boeing-type

craft from 1,620 to 2,000 hours, at testing in large maintenance hangars.

Increasing interest in X-raying techniques among airlines is evidenced by the fact that in the last six months, airline representatives have gathered at two symposia—one here and one abroad—to exchange information and establish criteria concerning the use of X-ray on modern aircraft. The U.S. training was sponsored by the Air Transport Association at Highland Park, Ill. and was held in cooperation with General Electric's X-ray department. It was attended by 40 airline representatives and GE instructors. The European symposium, sponsored by Carl Drexel X-ray Laboratories in Copenhagen, Denmark, was attended by 30 airline and X-ray industry representatives and X-ray industry representatives from 12 countries.

Portable X-ray Equipment

Portable X-ray equipment firms and suppliers in the U.S. are:

- **Aerdux.** These units of equipment are available through Higgs Anderson, Inc., San Francisco, also American Airlines for the El Paso route and American Airlines for the Dallas route and American Airlines for the New York route.
- **Raytheon World Service (Franklin Aircraft and Lake American divisions), Boston Air**

ways, Delta Air Lines, National Airlines, and Eastern Air Lines.

- **Navdux.** These units are available from North American Philips Co., Inc., Miami Division, N. Y. These units are made at the company's plant at Danvers, Hertsford, England using the equipment at United Air Lines, American Airlines, Capital Airlines and Trans World Airlines.

- **General Electric.** One unit is available through CE's X-ray Department, Milwaukee. W. A. G. E. makes a second model now large to be called into port (see).
- **Northwest Orient Airlines** has purchased one of each size.

- **Reliograph.** These units are being put on the market and distributed by West Explosives (Industrial) Products, X-ray Sales Department. (A little variation, the Reliograph, also is available.) The machines are made by the Bellevue Electric Co., Stockton, Calif. Only the transformers used in the equipment are reported from the company's head quarters in Leige, Belgium. No evaluations have been said to date, but demonstrations have been made for Pan American at New York International Airport and for Delta at their head quarters in Atlanta, Ga.

- **Fordex.** Four units are available through the Yale U.S. distributor,

Machinery and Welding Corp., Chicago. No sets have been sold in this country to date. Maker is Carl Drexel, Electrochemical Laboratories, Copenhagen, Denmark. The equipment is not yet on the market in Europe.

All of the above equipment can be carried by one or two men. Some of the smaller units are compact enough to fit into enclosed and inaccessible parts of an airplane. The sets are made up of X-ray heads, remote control units and connecting cable.

Quicker, Cheaper, Better

All X-ray users report that the equipment is easy to use and gets planes out of the shop and into the air quicker, cuts inspection time hours and therefore expense, and improves the quality of inspection. In using these X-ray portable inspection units which could be virtually impossible to accomplish visually.

The use of X-ray allows inspection to locate cracks and geometrically dangerous structural defects such as cracks, fatigue or corrosion which might otherwise never have been detected.

Example is BEM Royal Dutch Airlines' experience with experimenting with X-raying internal wing damage in a DC-6B at its former leading edge. There is what the carrier reports: "Two sheets of the duct showed back delamination. A third radiograph revealed that a Y section had completely broken loose and had tumbled outward about five feet. These three radiographs were actually made to detect cracks in the flat air duct hardware and the above mentioned defects were found by chance. The cracks in the duct, for reference, would never have been detected without the use of X-ray if not engaged in radiation. These experimental shots helped to convince us that X-ray really can do something in an airplane."

An English firm, Yorkton-Aerograph (Aircraft) Ltd., had this experience X-raying the wing structure on a large high speed aircraft aircraft which was damaged when a leading edge collapsed while taxiing. The position and condition of the air warning capillary tubes were adequately displayed and it was found that the fuel service pipe and attached to which valves were not of the quality normally expected. The partial absence of a capillary film of solder within the nipple that could easily be seen.

"It was found that the radiograph could be used as a test after a satisfactory control over setting, electrical leads and push film) looks being clearly displayed. In addition, the presence of dimensional welding components proved very interesting in nature."

"Check-up of the engine in looking over, taper pins, and bolts and

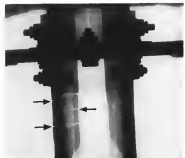
nuts which had been left within the structure, an assembly was shown to have sagged, due to vibration and maintenance, into critical areas. The possible consequence of this need not be elaborated."

Strongly possible by the use of X-ray can be seen from a statement by Pan American World Airways. The airline uses 41,500 man hours at the Miami Division. It has, by using portable X-ray equipment to inspect components, cut longer, propeller plane uses on DC-6B

and under wing area of 8-177's and 1-4-6's.

FAX reports that "both increased efficiency has resulted from the use of X-ray on airlines." ABOB has effected to annual savings of 12,800 man hours on DC-6B prop plane, 300 inspection, 7,000 man hours in inspection of the lower wing area at the main gate at 8-177's on a turbine, 600-500 man hour another 7,000 man hours on 1,040 hours in wing inspection.

"One further use of X-ray equip-



CRACK IN main edge of DC-6B is shown in X-ray. Right side view between two other horizontal views taken in actual work. Photo was taken during inspection of Charles E. Fox American World Airways' Miami Division Bus. Carrier was glad to try of wing and negative at bottom for photo.



PHOTO TAKEN BY Delta Air Lines shows structural wing shoulder plate (large circle) and two oval ones (smaller circles).



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Bee engineers, too, are busy every day solving new, possible problems related to many phases of flight—repertory, challenging design and production problems on behalf of vital, major aircraft components.

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E. G. Mohr, Industrial Relations Manager, Babcock Corporation, Chula Vista, California, Dept. 28



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most is placed with the installation of MOG's new X-ray unit; the company said. "In addition to greater use on aircraft structures, certain tests, such as oil leaks and B-777 nose gear cylinder assemblies will be checked by X-ray."

Image Intensifier

Nucleon technicians believe that at least one camera substantially the size and cost of X-ray inspection by using an image intensifier. The fluorescent screen can be moved along an aircraft's structure, allowing a technician to conduct a continuous, visual inspection of a large area instead of having to record a small section on film and making for it to be developed before being able to determine the integrity of the structure. "Automatic inspection is necessary because of the continuous and rapid manner in which inspection can be accomplished. (A gap of 20 seconds is possible) as well as the inferior resolution capability of a radiographic film. It is now able to inspect 1 in. of welded steel pipe at a rate of 2 inches per second.)

Over and over the savings due to faster inspection and swifter reduction in man hours are an appreciable amount in the need and difficult maintenance. With the intensive program and work, he takes of area where defects show up all data structure goes unexplored. Also, possible defect patterns occur due to improper repair, or the development, or an defect.

A Nucleon spokesman estimated that an intensifier could show X-ray inspection cost about 65%. A shot that normally about 55 could be made with an intensifier for about 51. The 54000 price of the unit would not take into account since using inspection alone of 1/2 DC-8-type plane requires about 68 exposures.

Clear Image

The intensifier's image is one that shows times brighter than images appearing on standard fluorescent screens, which allows the device to be used in average daylight. It produces a very clear image, which makes it easy for an operator to detect a structural flaw. By using a closed circuit television system, inspection can be accomplished remotely and all possible danger of infection effects are eliminated.

A Nucleon intensifier weighs 125 lb and measures approximately 15x10x10 in. Several companies make similar devices. A series of several articles and an issue investigations which use portable X-ray equipment for non-destructive inspection produced three observations.

• **Upright**—We use our Nucleon X-ray machine primarily for "extremities" structural inspection of aircraft during overhaul. Primarily because of the X-ray equipment, the FAA and CAB outlawed the long time between repair

intervals on the DC-6 and DC-8 from 1,600 to 2,000 hours.

The equipment is used primarily for wing tip inspection.

Other components inspected by X-ray include:

• Fuel injection lines to determine whether the slots additional joints are intact. (The single type of injection installed on a 512 000 wing in one year.)

• Electrical plugs to determine their integrity without having to cut them.

• Welding inspection, to determine the quality of the welding shop's work.

"A one-time X-ray inspection of five sections and assemblies of our fleet of DC-4 and -6 aircraft took approximately 270 man hours and cost \$15,000 per plane. Without the X-ray equipment it would have been necessary to remove the engine, inspect the interior, re-install the engine and test the plane at an estimated cost of 1,140 man hours and \$11,600. Savings was 1,170 man hours and \$12,000 per plane.

"In fact, our fleet of 35 Cessnas will undergo the same extraordinary inspection given to the DC-6-type aircraft."

• **Accessories**—We use X-ray equipment to inspect the following areas of our DC-6-type aircraft:



BALTOPHOT X-ray unit complete is easily carried to job by one man.



MOORE 100, 120 tubebanks with control.

"Control screen lower straps through the linkage to the bell crank and box beam component at a distance remaining straight parallel shafts of the motion with the linkage.

• **Branding fixtures and struts** in the propeller plane area without running current through shafts.

• **Control screen** without being in contact with the shafts with no moving to create the film.

As with these examples of cameras through use of X-ray as equipment.

"X-ray of the upper and lower front control arm cups, between 30 right and left of the center section without 3, moving members 1 and 3 laterally ball cells. Estimated savings is 50 man hours per plane.

"X-ray of section 122 and 175 right and left hand lower control section also for cracks on DC-8s for a saving of about 10 man hours per plane.

"X-ray of the box beam and ball track arrangement without having to dismantle the area or remove the DC-801 wheel axle about 35 man hours.

"Use of X-ray inspection will grow. But in practice, one will be in a checking device to inspect defects revealed by other inspection methods, or in



MOORE'S 300 3000 with field X-ray unit (left and control right).



X-RAY BEARING analyzer made by Nucleon

some times to confirm or deny defects which otherwise was indicated—but not confirmed—by prior examination."
•TWA—"We use our Nucleo X-ray machine to check the lower wing ribs on Convair/Boeing aircraft from the front to the rear span between wing stations 101 to 209 and locate defects 131 to 145. One unit is to detect side cracks which might be hidden under wing tip tape."

"We do not have any specific test fixtures or fixtures to test that X-ray inspection results in a very considerable saving."

"Although we have no immediate plans to expand the use of X-ray inspection at this time, this technique will undoubtedly be used in wider applications in the future, particularly in the inspection of beam engine parts."

•Delta—"Among the most useful applications of X-ray inspection is an airframe in checking the condition of wing struts in field cuts without removing the access doors and detouring the flight-line."

"Other uses required by X-ray in check a number of places adjacent to fuselage doors, stringers and crossmembers in the propeller plate area, and faster ducts and ribs in the laminar flow inlets. We also inspect air in the outer of DC-9's to avoid reworking the fabric."

"We have had several cases of cracks discovered in X-ray which could not be found visually. An example is an enclosed area doubler plate which had several cracks missing completely."

"Examples of non-heat treated stress X-ray inspection of wing struts at 1,500 hour intervals are accomplished on 70 man hours instead of the 135 man hours required. Also, not having to remove field cuts eliminates the possibility of damaging them."

"X-ray inspection of the propeller plate area can be accomplished in about 2 man hours instead of the 40 man hours previously needed to remove and install laminar flow equipment and reset lugs."



DUBARR (right) of various physical units. E—Fluorescent screen on which X-rays are received after passing through object to be examined. G, glass wall of tube. D—Support of fluorescent screen and photocathode. K, Photocathode substance produced in K release through from the photocathode. E, Helium source is reproduced on a window seal by electric field between K and perforated window A, on viewing screen F. This image is observed through a simple microscope. M, is a protective layer on the inside of the tube.



"We believe that X-ray inspection will become a 'must' with any aircraft. Example is the new type of stronger wood on the DC-7. Aircraft can't be stored in place. X-raying is the only way of detecting cracks. Now design team to have an increasing number of in-flight areas which make visual inspection impossible."

•Northwest—"Our X-ray work has developed to rapidly act to become a vital factor in our entire inspection program, and we are considering setting up a separate X-ray inspection program for even greater use in routine inspections. "This is a summary of the various uses to which we have put our GE X-ray machines in one year:

•Inspection of external surfaces of leading gear portions for corrosion and metal laceration.

•Inspection of propeller blades for flaws and to determine the condition of internal wiring.

"Check oil coolers for metal contamination (since X-ray cut the cut from 300 to 50) and verify hot oil cooler. We believe that we do not have to be dissatisfied."

"Inspect rot nuts for corrosion."

"Check the condition of welds."

"Inspect for inaccessible structural component for condition of support fabric."

•Northwest—"Inspection of DC-6 type aircraft fuselage at the propeller plate area need to include rapping out the entire tube, including lugs and ball the flange—a 300 man hour job. X-ray inspection does a more accurate job than visual inspection at 5 man hours."

"The time not out of the same aircraft is used in inspecting to inspect results and visual inspection was formerly required to test out the stress X-ray does it in 2 to 4 man hours."

"NAL will probably make a permanent X-ray installation to inspect overhead engine parts."

•Boeing—"The carrier does very much the same type of X-ray inspection in other series. Examples are lower struts in carrier section between 200

and 37 and 421, and between front and center spars (DC-6), lower skin and stringer inspection from station 125 to station 140. Convair/Boeing and other main landing gear side beams, which otherwise would have to be removed and reinstalled (DC-40).

"Small cracks in the typical main beam string attributable to the use of X-ray (the example refers to the DC-6 main center section inspection post seen below)."

For visual inspection
 Open and Close Inspection Plates
 (4 units at 6 hours each)

14 man hours
 Inspection (2 Inspectors at 3 hours each)

TOTAL—16 man hours
 40 man hours

For X-Ray Inspection
 X-Ray of the Area—3 man hours
 Film Development—2 man hours
 Film Interpretation—4 man hours
 TOTAL—9 man hours

Savings attributable to X-ray 25 man hours

"Here is a sampling of surface material" opposite of X-ray inspection.

•Douglas—"The use of X-ray inspection is growing on two fronts at DAC. The company is continually expanding the use of X-ray inspection on its production line, and it is underwriting the device as a useful tool in the inspection of the hundreds of Douglas aircraft in service throughout the world."

"In the future, Douglas anticipates believe that the next big advance in X-ray techniques will be the introduction of Laminar flow in Beech fuselage as smaller usage (aircraft) design and with closed cavity situations. Among the many advantages of such a situation is the possibility of using the internal fluorescence of components in actual operation."

"On the commercial transport side, Douglas inspection recently presented, handled by W. G. Harts have been developing techniques for taking and interpreting X-ray photos of aircraft structures for the purpose of inspection without destruction."

"The accuracy team has not yet arrived at a standardized procedure to be used with aircraft in service."

"However, Douglas personnel have developed techniques which with laboratory operations and some want to check. Once with service aircraft to enable them to prepare an X-ray inspection manual. Data for the manual are currently being compiled by a team of Douglas Service Department men and men in the field working with airlines to accumulate the data, using test cases developed in company's lab."

"Douglas has approached six airlines using its equipment, asking them to cooperate."

•Boeing—"The company recently conducted

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ated a Norden Mily 150 X-ray machine is applied to inspection of certain components of an atomic reactor stack. Here is a summary of the evaluation.

The rad stack can be placed inside a pressure vessel component allowing radiographic inspection of the entire stack with a single exposure. The maximum exposure setup time is 20 min over a single continuous strip of 70 mm film can be wrapped around the outside of the vessel. Also, quantity of film used is cut 75% over the previous method which involved taking eight separate exposures of a girth weld from inside the assembly with the film on the inside.

Another application of the X-ray machine is to verify non-destructive test sets for fissure control. Its use is to inspect the tube vertically, so the zone of radiation will be along a horizontal plane from outside film to film in a circle around the inside and inspected cross-section. A considerable time saving can result.

In a further test, the rad stack was placed inside a test rack device, aluminum casting and the film wrapped around the outside. Results were radiographs acceptable for fissure control yet exposure time was reduced 75% and quantity of film used was cut to 1/2.

The report concludes that, as

atomic fuel vessels alone, savings per stack amount to \$94.11 and 4,676 square inches of X-ray film, which cost about \$15.

•**Lockheed-LAC** thinks the X-ray response is most useful to look for fatigue failures in high stressed areas of high time aircraft.
Example of cost saving at Lockheed (LAC), it cost \$5,000 to remove a C-54's engine's wing and inspect it. Using X-ray equipment, the job cost less \$1,500.
Lockheed technicians anticipate greater use of X-ray equipment and techniques.

Expansion of X-ray operations into military operations is indicated by a special X-ray response course recently conducted by GE for the USAF at Hill Air Force Base, Ohio. Utah Representatives from GE, Air Materiel Assoc, except San Francisco, were present to attend the two weeks course.

Here are summaries of the two recent X-ray symposiums held in Capas, Laguna, under the auspices of the Carl Dreyfus X-ray Laboratories and in Highland Park, Ill., under the sponsorship of ATA and GE.

•**Copencolony Meeting**
•**Inspection Equipment Co., London** is an industrial meeting symposium that radiology makes its most important contribution to solving the cost of keeping airplanes flying.

An essential requirement is a control and "information system" to let an operator know for all matters pertaining to X-ray responses of aircraft.

The process of accelerating technology is... the most expensive part of radiography. In Europe, acquisition of aircraft is now not a step at the stage. In America, a number of airlines have already reduced at least part of their radiography to routine procedures.

Doing so, Lockheed has been of considerable help.

X-ray response checks have made a contribution to the reduction of maintenance costs—but it could make a much more serious contribution.

•**Scientific Airlines** The company stated that its experience was limited to its first experimental flights on DC-4 and -6 structure, the carrier encountered these problems: The following:

•**How can one obtain a radiograph of an aircraft when the aircraft is being X-rayed in a conventional manner?**

•**How can one be sure that all the results will be shown on the radiograph?**

•**How can all film radiations be eliminated?**

These problems have to be solved to make radiography of aircraft structure 100% reliable, the airline said.



The art of rocketry

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space between the object and the film should be as small as possible and the distance between the object and object should be as great as possible.

Image contrast depends on the film used and on the quality of the radiation.

"The Kodak representative warned," in making an X-ray film, it is just as bad and that images may arise from (1) surface marks on the film such as smudges or scratches in the print; (2) some film internal defects such as cracks; (3) faults in drying, handling, exposure processing, or during the film if any doubt exists about the image, the shot should be repeated.

"When establishing the significance of the information provided by radiographs, it is desirable to note the limitations of the method.

"No useful information is obtainable at all of internal film to penetrate the structure. And the absence of image of a crack on the film must not be taken as evidence that no cracks are present. Cracks will be revealed only if the direction of the X-rays approximately coincides with the plane of the crack.

"Technically, cracks rarely follow the same plane in three or a few parts of a structure thus.

"Other representative made comments which generally reflected the opinion expressed by American experts.

• General Electric, Dr. E. Dale Trout, consulting radiology physicist for GE, X-Ray warned, "The biggest mistake a company can make is to try an X-ray workup in the period. Right might you be on to trouble, but you also introduce a lot of adequate protection from radiation."

"Another mistake is to depend on a conventional Geiger counter to measure radiation.

"A final mistake is failing to consider the "dose deposition" of the instrument used for measurement. It should be calculated to avoid an early diagnosis perhaps at the same length with a lock you are X-raying.

"The best and cheapest protection from radiation is distance."

Dr. Trout warned the symposium of the urgent need to establish consistent standards for radiology protection in the use of industrial X-rays. He added, "Unfortunately, industrial X-ray has now established a set of standards for what the present-day usage of X-rays may be in the variety of the industry."

"There is also a lack of understanding in the behavior of radiation. The amount of radiation, the distribution of X-rays around the cut part and behind the nucleus, and the many other factors which must be considered before one can say that an installation is safe or unsafe."

He added that a criterion of at

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standards be established for all contractors to follow.
* Northwest Orient Airlines, Dr. J. J. (Doc) Huntington, representative of service engineers, presented many case histories in which the use of X-ray generated images, reduced overhead time, and increased ground time.

In his closing remarks while most X-ray work is now done at one central checkout base, the future X-ray will probably be done at line stations to which it will pass on the line back to one man assembling.

While we are only in the early stages of X-ray use, we already have evidence of the method and expect to use more and more in the future."

The services of the more 40 X-ray specialists throughout the U.S. and Canada were offered to the audience to help them get the most out of their X-ray equipment.

As a result of the meeting, a steering committee is being organized by Alton W. Dittus, ATIA director of the Engineering Division to accomplish the same.

* Corbett, suit and dressmaker instructions in the use of X-ray in the air line industry.

* News in a special exchange point for information among the airlines.

* Special feature periods covering in the same subject.

Dittus said that both public safety and profitability require operation reports that we give greater emphasis than ever before to the use of X-ray, and other non-destructive testing methods. "It is the object of portable X-ray equipment, which can effectively use the techniques in failures accessible areas without disturbing aircraft structures."

Toil X-Ray Rig

Douglas designed the mobile X-ray unit to perform non-destructive inspection on its B760 and C-119 aircraft (although here it is shown beside the tail of a C-119).

The mobile X-ray unit will be used for production inspection. On each B-760 and C-119, 153 closed area X-ray units are used.

With the new rig, five men in an hour can do the work which formerly required 16 or 17 men up to 12 hours to accomplish. The track mounts a hydraulically-operated telescoping mast which carries a 140 lb. portable X-ray machine. Operated from a control panel on the track, the mast can be raised to a maximum height of 40 ft. The adjustable frame at the mast controls the beam and can be rotated 180 deg. to give complete accessibility to any portion of the airplane.

OFF THE LINE

A \$200,000 contract for a production type, two-piece 362 piston engine cylinder has been awarded to Winchester Piston Metal Co. by the Navy. The cylinders, which are 13 in. diameter and 10 in. long, are designed from a flat blank.

New cast leader (which can hold down cast directly at an angle) and other new castings has been put on the market by Golden Bear Mfg. Co. The company reports the product is used at Edwards Air Force Base, Calif. The announcement says the leader is less expensive than frequent cuttings is not harmful to metal, needed once and does not startle the end. Address: Commercial Div., Golden Bear Mfg. Co., P.O. Box 8188, Omaha, Neb.

A price increase of 75% has been effective Aug. 1 on all General Electric Industrial gas, oil, water and greasing equipment on an 18-in. line of industrial gas turbines.

A new, high range turbine and control chemical fuel will be produced for the Air Force by Dow Midwestern Chemical Corp. in a \$10-million plant to be erected at the Lela, Ontario Ordnance Works, Model City, N. Y. A second turbine plant will be built in the same location (and name of "Norgas") later to produce the same fuel for the Navy. The new facilities will be erected by the corporation's recently formed Aviation Division.

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M. J. & C. Co., 2100 Broadway St., Memphis, Tenn. (contract 61-03-150-0002) \$75,000

M. J. & C. Co., 2100 Broadway St., Memphis, Tenn. (contract 61-03-150-0003) \$75,000
M. J. & C. Co., 2100 Broadway St., Memphis, Tenn. (contract 61-03-150-0004) \$75,000

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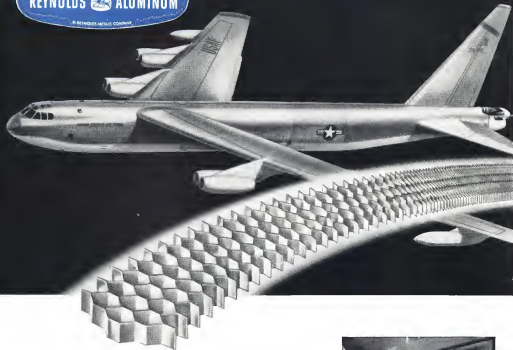
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